This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

PL RESEARCH LIBRARIES
433 06275603 0

THE

CIVIL ENGINEER AND ARCHITECT'S

JOURNAL,

SCIENTIFIC AND RAILWAY GAZETTE.

VOLUME III.—1840.

NEW YORK PUBLIC LIBRARY

ASTOR LIBRARY NEW-YORK

LONDON:
PUBLISHED FOR THE PROPRIETOR, 57, KING STREET, WESTMINSTER;
H. HOOPER, PALL MALL EAST; GROOMBRIDGE, PANYER ALLEY, PATERNOSTER ROW; J. WEALE, 59, HIGH HOLBORN; J. TAYLOR,
1, WELLINGTON STREET, STRAND; J. WILLIAMS, 106, GREAT RUSSELL STREET, BLOOMSBURY
WILEY & PUTNAM, NEW YORK.

LONDON:
THOMAS BURROWS, 57, KING STREET, WESTMINSTER.

PREFACE.

This year has been less remarkable for great events than for the steady and gratifying progress which has been made in every branch of the two professions, to recording the labours of which our Journal is devoted. The financial embarrassment of the country, and the course of political events, have been far from favourable either to the promotion of existing undertakings, or the formation of new ones. With regard to architecture, it must have been gratifying to our readers to have witnessed the increasing interest which has been shown by the public of late years on this subject, manifested by the demand for competitions, and the extended discussion of architectural topics in the higher class of general periodicals, while a strong feeling seems to prevail as to the necessity of enlightening the public mind, and bringing it to bear upon this as upon other branches of the arts. Architecture has at last been recognized as a subject for collegiate education, by its introduction into King's College, and by the formation of architectural schools in the national dockyards. The Royal Academy has given signs of a more liberal disposition towards the profession, by the election of Barry, notwithstanding his known connexion with the Royal Institute—a step highly important. The Institute of Architects of Ireland has been established, and the royal patronage bestowed upon it. The Revival style, as we announced last year, has now gained a footing in this country, at the same time that considerable progress has been also made in internal decoration by Parris, Latilla, Owen Jones, and other artists of talent; so much better disposition is now shown to unite this branch of the arts with architecture, that there appears every prospect of the Houses of Parliament being painted in fresco, although we hope not, as has been suggested, by foreign hands. The temple of English freedom should never be desecrated by strangers.

We have not this year, as previously, to regret the loss of many great edifices, although York Minster has suffered considerably by fire. Among the ancient buildings in which restorations or improvements have been carried on, may be mentioned Westminster Abbey, the Temple, St. Aldate's, York Minster, Thorney Abbey, St. Mary Nottingham, St. Michael's Basingtoke. Few buildings of any note have been completed, although many are in a satisfactory state of progress; we may, however, mention the Reform Club, the Club Chambers Association, the Princess's Theatre, and the Manchester Unitarian Chapel. Several fine railway stations have been erected, and cemeteries opened in London and different parts of the country. The subject of a change in the system of prison discipline now in agitation, seems to promise, at an early period, extensive employment for the profession, as also the question of national education, and the construction of school-houses consequent thereon. The profession in Ireland has been largely employed in building union workhouses, some of which are on a large scale; a prospect also exists of similar employment for our Scotch brethren. It will be a matter of gratification to consider that the important question of the architectural and sanitory police of large towns is now attracting much attention. Something therefore may be expected to be done.

Among the architects whose loss we have this year to regret, are Sir Jeffry Wyatville, Albertolli, and Mr. Whitwell.

The engineering profession although having greater obstacles to contend with than the architects, have shown rather more vigour, and will require therefore a more lengthened statement of the progress they have made. Engineering education is making still greater advances, a new faculty has been established at Glasgow, and the first Regius Professor of Engineering appointed, the other faculties have been improved; at King's College the architectural instruction has been extended, and a lower school formed for elementary instruction. To the Mining schools we shall hereafter have occasion to advert; we may farther mention the increased qualifications required of enginemen by the Admiralty, the examination of officers on the steam engine, and the delivery of lectures at the Royal Naval College, the establishment of a College for Civil Engineers at Putney, and the project of a School of Practical Engineering at the Polytechnic Institution. While at this point we may mention that honorary degrees have been conferred by the universities, upon several engineers, and also upon Junius Smith, the great promoter of Atlantic Steam Navigation. The University of Edinburgh have ordered from Chantrey, a statue of Watt, being the sixth of that great man, and the Institute of Civil Engineers have this year offered premiums for memoirs of eminent engineers; we regret however, to remark, that no disposition has been shown by the Government to bestow the same honours upon this as upon other professions. Prizes have been awarded by an Association at Glasgow, for improvements in safety valves. The local exhibitions of arts and manufactures have acquired this year still greater extension, and probably we shall not long wait for a national exhibition in the metropolis.

The railway system has in several ways prominently attracted public attention. We shall first advert to the number of lines which have been this year either wholly or partially opened. Among these are, the Great Western, Brighton, Blackwall, Eastern Counties, Northern and Eastern, North Midland, York and North Midland, Manchester and Leeds, Hull and Selby, Glasgow and Ayr, Glasgow and Paisley, Maryport and Carlisle, Preston and Wyre, Lancaster and Preston, Chester and Birkenhead, Chester and Crewe, Manchester and Birmingham, Birmingham and Gloucester, and Taff Vale. On nearly all the great lines most fearful and unprecedented accidents have within the last few months taken place without any satisfactory cause for their extent, they seem indeed to be the result of a similar mysterious visitation to that by which steam navigation was afflicted last year and the year before, and from which it has been this year free. Government have been as usual meddling this year, and we regret to say with greater success than before; besides employing parliamentary committees and itinerant commissioners who have been employed on the Scotch and Holyhead routes, an act has been past for giving the Government an unprecedented control over the lines. Only one bill for a new railway passed last session. The system of leasing small lines to other companies, and of the union of lines has been much extended. Rope traction has now been shown on a considerable scale on the Blackwall railway, on which wire rope is proposed to be used, and a large experiment has been made of the pneumatic system, on the West London Railway. Electric telegraphs have received some improvements, and their utility for railway purposes may now be considered as finally recognized. The French government have this year shown a better spirit as to the railways, but they make but small way, the Paris and Rouen projectors have however raised large sums in this country. The Russian government have sent an engineer to this country to prepare for the formation of railways in Russia on a large scale, and it may be observed that generally the European nations are making progress as to the introduction of the system.

The use of wood pavement for the streets has greatly extended both in London and the provinces, and the use of asphalte also seems to be established. Measures are in progress for running locomotives on common roads.

The appointment of commissioners for inquiring into the state of our coasts, has been a measure long called for by the mercantile interests of this country; but whether the recent labours of the harbour commissioners will either prove satisfactory or useful, yet remains to be seen. During the year improvements have been made at Leith, Fleetwood-on-Wyre, the Bute Docks at Cardiff, Ramsgate, Rye, and Woolwich. In this latter establishment we may also call attention to the introduction of the steam machine for making shot. At Granton a pier has been erected; in the Downs a safety beacon on a new principle; and this year we have seen the first application of the screw pile system to the erection of a lighthouse at Fleetwood-on-Wyre. Considerable attention has been devoted to the embankment of the Thames, into which subject Parliament has inquired; the river works of the new Houses of Parliament have been completed, and hopes are entertained that either by the city or goverment, works will be carried on so as to improve the whole north bank of the river; an extensive embankment on the shores of the Thames and Medway has been made by Lord de Vesci. The propositions for draining the Lake of Haarlem, and for recovering land in Morecambe Bay and the Wash, have caused many engineers to direct their inquiry to improvements in draining, as far as regards the application of mechanical power to such purposes. The Chard and the Ulster Canals have both been opened, and some extensive works completed on the Hereford and Gloucester. The repairs of Blackfriars Bridge have been satisfactorily ended, while great progress has been made with those carried on at Westminster Bridge; some majestic viaducts have been constructed on the railways. The application of Rendel's system of floating bridges has been extended to Portsmouth and Calcutta.

The interests of steam navigation having been seriously threatened by the proposed application of stringent government measures, we considered it our duty to awaken the attention of the marine engineers to the subject, and we congratulate our readers on the success which attended our efforts, such a union of the profession having been organized, and such effective measures taken, as to compel the authorities to postpone the intended bill. The importance of steam ships as a part of our marine, has been shown by recent hostile events, when the agency of this arm, both in Syria and China, has been so exerted. The government have shown their sense of it by giving higher rank and privileges to the enginemen in the naval service, by directing schools for their instruction to be formed in the dockyards, and by making an acquaintance with the marine engine a part of the studies of the superior officers. The French government have greatly enlarged their engine factory. The investigation of the properties of the Archimedean screw has been continued, and its utility recognized, at the same time that the question of modes of propulsion has been the subject of extensive experiment. The application of propellers to sailing vessels, as in the Earl Hardwicke and the Vernon, has been successful. The introduction of steam navigation on canals, has also tended to direct attention towards propellers, and to the use of iron as a material for steam canal boats and for passage boats, of which the Lee, the Nonsuch, and the Alice are examples. Iron has been so extensively used as a material of construction for steam boats, as already to have given a great deal of employment to marine engineers. Abroad, iron steam boats have been introduced on the Danube and the Elbe. Iron has been applied considerably for constructing sailing vessels; it has also been used for a floating fire engine. The experiments continue on the application of electro-magnetic power to navigation, but with no tangible result. Steam navigation has, this year, been greatly extended; Fleetwood-on-Wyre has been added to the steam ports; the Mediterranean service has been more efficiently organized; in the Atlantic the number of steamers to the United States has been increased, and a line to Boston established, communication with Madeira has been opened; in the Pacific, steamers are now running along the western coasts; in India, increased means of communication with England still occupy the public mind; attention has also been directed to the capabilities of the Indus and its tributary streams.

Mining is greatly advancing as one of the branches of the profession, or a branch likely to be promoted by the measures taken for giving instruction in it. The munificence of Sir Charles Lemon has established in Cornwall a special school for mining, and professorships also exist in King's College, London, and at Durham. Instruction in mineral chemistry, so much required, has been promoted by the establishment of the government school attached to the museum of economic geology, and by the courses delivered in several public institutions. The powers of Cornish engines have been the subject of serious discussion among our engineers, and the attention of the Dutch government has been directed to them to ascertain their applicability for economical draining.

Among the engineers who have been this year lost, we have to mention with regret, Sir Robert Seppings, Lieut. Thomas Drummond, and Mr. Hazeldine, an engineer employed on the Menai and Conway bridges.

Having thus disposed of the interests of our readers, it remains that we should ask their indulgence while we recall to them the exertions we have ourselves made in fulfilling our duties towards them. For this we appeal with confidence to the volume just concluded, where they will find that our correspondence has increased in value and interest, and that no exertion or expense has been spared to render the work worthy of the increased patronage it receives. Our readers will find in it 432 pages, 21 plates and 214 engravings, forming a mass of information which, for value and for cheapness, is not surpassed by the periodical works of any profession. Such have been our endeavours in our communication with the professions through the medium of these pages, but we have not hesitated, neither shall we, to exert ourselves for them, when and where we may have it in our power, by acting in a public capacity. Such we considered to be our duty on the steam navigation question, as we shall on every occasion where the interests of the professions require it, and our humble efforts can in any capacity be exerted in their defence.

INDEX.

Air, passage of, through pipes, 300.
Antiquities:—Egyptian, 12; St. Mary Aldermary, 25; Perranzabuloe, 90; Bilingual inscription, 132; tombs at Cære, 209; tumulus at Bougon, 231.
Aqueduct at Dijon, 398.
Arabesque decorations, 94.
Arch, expansion of, 133.
—— origin of, 354.
—— pointed, 318.
—— skew, 109, 116, 152, 179, 197, 230, 231, 232, 274.
Architects, *vide* biography:—Bartholomew, A., 259, 301, 330, 365; Blore, E., 255, 257; Brown, 54; Cottingham, C., 249; Donaldson, T. L., 2, 147, 209; East, F., 322, 354; Francis, F., J. 337; Fripp, S. C., jun., 105; Godwin, G., jun., 210, 217, 249, 258; Harris, W., 179; Jones, Inigo, 3; Poynter, A., 94; Pugin, A. W., 197, 215, 225, 228, 257, 272; Tattershall, R., 2; Thomson, J., 261, 321; Tite, W., 223, 258; Walker, T. E., 25, 39; Watson, J. B., 215; Wightwick, G., 254, 272, 301. 352.
———— table of, 112, 140, 147, 183.
Architects, Royal Institute of, 69, 93, 136, 209, 211, 248, 261, 285.
Architects of Ireland, Institute of, 132.
Architectural Society, 35, 248, 427.
Architecture, *vide* Buildings, Ecclesiastical, Architects, Engineering, Stone, Iron, Timber, Arch, Competition, Ralph, Candidus, Rambles by Philomusæus, Medieval Architecture, Gardening.
———— Abbotsford, 3; Architectura Domestica, 34.
———— arch, origin of, 354.
———— at home and abroad, 90.
———— beauty of outline in, 329; Blenheim, 262; British Assurance Office, 225; Buckingham palace, 156; buttresses, 365.
———— Byzantine style, 219.
———— Cambridge libraries, 32; Capitol, Washington, 293; capitals, 373; churches, 75; church pews, 225.
———— chronology of styles, 143; columns, 143, 156, 373; cornices, 250, 329; distinctive causes of Greek and Roman, 337; East India House, 293; Edinburgh, 156; German architects, 91;
————Government school, 327.
———— horizontal and vertical line, 137, 186, 210, 228; house decoration, 363; Italian, 156; landscapes abroad, 4; landscape gardeniug, 52.
———— history of English, 2.
———— Liverpool, 356, 410; Mansion House, 294, 399.
———— Medieval in France, 143, 219; Munich, 91; National Gallery, 3.
———— origin of vertical line, 137.
———— original composition, 261.
Architecture, painted glass, 217, 249, 255, 258, 276, 373; Pantheon, 293; Parisian houses, 310; pinnacles, 365; pointed arches, 318.
———— porticoes, 293, 356, 389.
———— profession in France, 7; public walks, 85.
———— Reform Club, 75, 141, 329; revival style, 257.
———— Romanesque style, 143; Royal Academy, 187.
———— Russian, 93.
———— St. Genevieve, 293; St. Martin's, 263, 294; St. Paul's, 227, 329; St. Paul's, Covent Garden, 293, 373.
———— shops, London, 43.
———— simplicity of plan, 3.
———— slate, 73.
———— Soane museum, 155, 301.
———— table of buildings erected in Paris in the 19th century, 203.
———— table of porticoes, 389.
———— Vanbrugh, 262, 321.
———— Vatican, 94.
———— Whitehall, 3, 264; windows, 3.
———— wire fences, 49.
———— York column, 156.
———— naval, *vide* Ship-building, Steam-boat, Boat.
Armstrong, R., on Cornish engines, 4; on steam

engine technical terms, 89; on indicating power, 126.
Artesian wells, 20, 51, 99, 118, 249, 264; absorbent, 118.
Asphalte, artificial, 215, history of, 427.
Bald, W., on the Broomielaw Wier, 415.
Barrett, H., on moving beach, 195.
Beach, moving, 195, 237, 239, 258.
Beam, trussed, Laves's, 161.
Beaufort, Duke of, mansion, 226.
Biography—Albertolli, 147; Alison, Rev. A., 24; Archer, T., 249; Beazley, C., 147; Broderip, C., 142; Davy, Rev. M., 23; Drummond, T., 164; Dudley, 390; Telford, 30; Gilbert Davies, 66, 99; Johnston, F., 183; Lushington, E. L., 24; Muss, 217; Perry, Capt., 108; Peterborough, Bp. 23; Pitts, T., 164; Prevost, P., 24; Prony, De, 24; Repton, 52; Rigaud, 23; Saunders, 24; Seppings, Sir R., 211; Telford, 30; Whiterell, 211; Wyatville, Sir J., 130, 286.
Blasting, *vide* gunpowder, Royal George, 215; under water, Dresser's plan, 341; limestone rock, by Bald, 165.
Blowing up Cannon-mills Bridge, 291.
Boat, iron canal, 175.
Boring, 198, *vide* Wells.
Botanic Gardens, Regent's Park, 173.
Brick machine, Bakewell's, 160; Bedborough's, 175; White's, 184.
Bricks, 144, 155, 160, 175, 180, 255, road, duty free, 255.
Bridges, *vide* hydraulic, arch Ardrossan, 29; Belleek, 344; Blackfriars, 286, 327; blowing up, 291; Broomielaw, 415; Calcutta, 398; Chinese, 268; Enniskilleen, 344; floating, Portsmouth, 215, 398; Gloster, 31; Hann's, 31; iron, 161; Menai, 193, 268; Portsmouth, 137; rope, 268.
Suspension, Dredge's, 193, 286; Haslar, 384; theory of, 268; fall of, 345.
Teignmouth, 38; timber, 358, 422; trellis, 152; trussed, Laves's, 161; Victoria, Bristol, 193; Westminster, 177; wire, 268; wood, 125, 161, 175.
British Association, 357, 386, 420.
Bude light, 18.
Building—Arch, 109, 116, 133, 152, 179, 197, 230, 231, 232, 274, 318, 354; beam, 161; cement, 266; concrete, 120; covering roofs with planking, 424; mica, instead of glass, 346; papier mâché, 201; porcelain letters, 176; puzzolana, 266.
Buildings, *vide* Ecclesiastical, Architecture, Theatre, Ashton Court, 52; Assize Courts, Liverpool, 158, 190; Bank, London and Wesminster, 84; ditto, Rochdale, 255; ditto, Savings, Finsbury, 217; ditto, Union, 183; Bielefeld's works, 8, 160; Blenheim, 262, 286; Capitol, Raleigh, 394; Chatsworth Picture Gallery, 286; Claverton Inn, 130; Cobham Hall, 53; Collegiate Institution, Liverpool, 255; Courts of Law, 210; Elizabethan shop fronts, 257; Fitzwilliam Museum, 88; Hospital, Bedworth, 39; Jail, Peterboro. 27; Mansion House, 294, 399; Market, Llandovery, 39; ditto, Bodmin, 179; Merchant Seaman's Institution, 251; Pantheon, 195; Pavilion, Brighton, 53; Polytechnic Institution, 321; Reform Club, 75, 141, 329, 409; Redbourne Hall, 257; Royal Exchange, 67, 132, 199, 210, 224, 399; Southwark Institution, 363; Theatre, Adelphi, 394; ditto, Princess, 394; Townhall, Ashton-under-Lyne, 255; ditto, Helston, 179; Victoria Rooms, Bristol, 411; Warwick House, Birmingham, 128; Woolwich Workhouse, 68.
Calculating balance for engineers, 21.
Canal boats, iron, 175, 314; Chard, 327; Erie, 124; friction dynamometer, 384; Gloster and Hereford, 178, 398; lockage, 384; lock valves, 396; Stafford and Worcester, 215; steam navigation, 398; traffic, 311, 376; Ulster, 344; Wyerley, 177.
Candidus's Note Book, 3, 75, 118, 155, 224, 271, 301, 333, 373, 402.
Cannon boring, 172.
Carriages—Adams vertebrated, 56; break, 26, 175; Curtis's truck, 5; draught of carriages, 20; effect of curves on, 267; friction wheels, 291; resistance of, 169; screw jack, 386.
Cement, 266.
Chain cable, recovery of, 395.
Chapels, *vide* Ecclesiastical Buildings.
Chatterton monument, 105.
Churches, *vide* Ecclesiastical Buildings.
——— on rebuilding old, 190; Catholic, 197.
Clarke, Hyde, on absorbent Artesian wells, 118.
Coal, combustion of, 412; India, 216; properties of, 423.
Coalfield, Forest of Dean, 347.
Cofferdam, Neville, on pressure of water on, 78; new houses of parliament, 283.
College for Civil Engineers, 57; King's, 68, 426.
Column, Nelson, 178, 211, 327, 355, 379, 413.
——— General Clayton's, 181.
Colours, Nobili's, plate of, 207.
Compass pivots, 422.
Competition Designs, *vide* Exhibitions, 7, 61, 130, 132, 158, 173, 224, 331, 371, 378, 406; Bury St. Edmund's, 331, 371, 406; Cardiff, 61; Ireland, 378; Oxford, 378; drawings, exhibition of, 194.
Concrete, patent, 120.
Cotton gins, experiments on, 313.
Curtis's railway truck, 5.
Cycloidal paddle-wheel, 35.
Dagenham breach, stopping of, 106.
Dock—Bute, 167; Chatham, 120; Liverpool, 362; Woolwich, 27, 37, 120, 362, 363.
Draining, *vide* Water, Hydraulic, Fleet sewer, 398; Haarlem lake, 327; Fiskerton, 362; Fairbairn on, 412.
Dry rot, 26, 27, 418.
Dyer, C., Victoria Rooms, Bristol, 411.
Earthwork in cuttings and embankments, method of computing, 334, 413.
East, F., on the origin of alphabetic writing, 403; on the horizontal line in architecture, 186, 228.
Ecclesiastical Buildings, *vide* Architecture, Ashted church, 399; Arles, St. Trophime, 144; Ash church, 215; Attleborough church, 39; Athens cathedral, 220; Atherstone convent, 393; Avignon cathedral, 143, 144; Basingstoke church, 339; Bedford, St. Paul's church, 288; Bethnal Green church, 362; Birmingham church, 179; Blackheath church, 71; Boston Wesleyan chapel, 399; Bow church, 200, 329; Caen, St. Peter's 329; Calcutta cathedral, 71; Camborne church, 171; Catholic churches, 228; City cemetery, 363; church pews, 225; convent, Birmingham, 215; Darlington church, 32; Dukinfield Unitarian chapel, 2; Falmouth church, 255; Flushing church, 255; Freiburg cathedral, 329; Golden Hill church, 327; Great Haywood church, 399; Guilsborough church, 254; Handsworth church, 215; Hill Top church, 327; Horsham church, 255; Keswick church, 32; King's College chapel, 329; Lanner church, 255; Lower Beeding church, 255; Lee church, 288; Liverpool, St. Barnabas, 71; Messing church, 215; Mile End church, 39; Monetes Keras, 221; Mosque, Armedabad, 329; New Catton church, 288; Nottingham, St. Mary's, 215; organ, 357; painted windows, 217, 249, 255, 258, 276, 373, 399; Panagia Lycomido, 220; Plymouth, Trinity, 254; Poitiers, St. John's, 144; ditto, Nôtre Dame, 221; Portreath church, 255; Ravenna, St. Vital, 219; Ramsgate church, 363; Rome, St. Paul's, 179; Ryde church, 409; Russian churches, 93; St. Bride's, 329; St. Dunstan's in the East, 330; St. Paul's, 227, 329, 330; Salisbury cathedral, 329; Sancta Sophia, 220, 221; Salt church, 179; Sergius and Bacchus church, 220; Stone church, 318; Temple church, 255; Thorney abbey, 255; Tours, St. Martin's, 143; Westminster abbey, 249, 276, 302; Wolverhampton church, 39, 71, 399; York Minster, 211, 276.
Electro-chemistry and metallurgy, 324.
Embankment, *vide* Hydraulic. Morecombe Bay, 71; near the Medway, 258; Thames, 258, 359, 383; Lough Foyle, 346.
Engineering, *vide* Arch, beam, blasting, brick, bridge, canal, college, concrete, dock, gas, geology, harbour, hydraulic, lime, lighthouse, machine manufacture, mining, pavement, pier, pump, railway, river, road, steam, surveying, wall, water, Alexandria, 39; American, 123; arches, skew, 109, 116, 152, 179, 197, 230, 231, 232, 274; earthwork, method of computing, 334, 413; photography, 385; profession in France, 7; teachers of, One who has suffered, &c., 148, 189.
Engineers, *vide* Biography. Armstrong, R., 89, 127; Bald. W., 165, 197, 309; Barlow, W. H., 275; Buck, G. W., 197, 231, 274, 308; Cockerill, J., 39; Curtis, W. J., 5, 76, 129; Hodgkinson, E., 248; Hughes, S., 334; Mitchell, A., 322; Neville, J., 78; Nicholson, P., 230, 274; Parkes, J., 282; Rennie, G., 25, 133; Rennie, J., 237; Seaward, J., 374; Smith, Junius, 400; Wicksteed, 10, 282, 367.
Engraving, galvanic, 148, 164; daguerreotype, 280.
Exchanges, history of, 223.
Exhibition, designs for Royal Botanic Garden, 173; Royal Academy, 187, 222, 257.
Fairbairn, W., on draining, 412.
Fine Arts—Rouen, 39; Arabesque, 94; British Museum, 12, 84, 394, 404, 417; Chatterton monument, 105; Fresco, 226, 278; Soane Museum, 155, 301; Gallery of Arts, 132; glass painting, 217, 242, 255, 258, 276, 373, 399; Hampton Court, 164; School of Design, 164, 250; Huskisson statue, 86; July column, 250; painted window, 431; Napoleon monument, 327; Redbourne Hall, 278; Rouen, 39; Oxford memorial, 286, 393; stone and bronze, comparison, 355; statues, 394.
Fleetwood-on-Wyre, 400.
Fresco painting, 226, 278.
French historical commission, 171.
Fuel, 134, 176; Edward's, 363; combustion of, 412.
Gardening, public walks, 85; landscape, 52; wire fences, 49; botanics, 173.
Gas, *vide* Bude light. Antiquity of, 263; account of, 137; bituminous schist, 308; regulator, 386; Seguin's, 29; Val Marino's, 26.
Geological Society, 68, 99.
Geology, *vide* Harbours, Mining, Stone, Lime.
——— Bendable stone, 183; Bourne river, 103; Cornwall, 39; coal, India, 216; ditto, Forest of Dean, 347; earthquake, 71; economic, museum of, 380; encroachments of sea, 39, 64, 167, 189; fossils, Horsham, 255; landslip, 71, 216; London clay, 249; moving beach, 195, 237, 239, 258; petroleum oil well, 363; Sheppy, Isle of, 25, 189; solubility of silica, 282; Venice, 71; Vistula, 210.
Gilding metals by electricity, 277.
Glass, flint, manufacture, 316.
—— Mica as a substitute, 346.
—— Painting, history of, 217, 258, 276, 373.
Great Western Steam-ship Company, meeting, 158.
Groundrope apparatus, 87.
Gunpowder balistic clock, for proving, 21.
Harbour, *vide* Lighthouse, Geology, Dock, Beach, Hydraulic, Tides.
——— Aberdeen, 29; Ardglass, 146; Algiers, 265; beach, moving, 195, 237, 239, 258; Beachy Head, 240; Brighton, 286; Broadstairs, 237; Crane, 28; Cuxmere, 239; safety beacon, 345; Dantzick, 229; Deal, 195, 237, 259, 345; Dover, 21, 146, 167, 195, 238, 240, 259, 321; Dublin Bay, 146; Fleetwood, 132, 181; Folkestone, 21; Hastings, 238, 259; Kingtown, 146; Leith, 71; Littlehampton, 240, 259; Lowestoft, 145; Margate, 237, 240, 259; Newhaven, 239, 259; Pagham, 240; Penzance, Palmer's Report, 21; Portrush, 146; Ramsgate, 21, 195, 237, 259; refuge, Mr. Barrett, 145; report on South Eastern, 236, 259, 321; Rye, 238, 259; Sandwich, 237, 253; Shoreham, 38, 239, 259; Swansea, 21.
Harvey and West's valve, 41.
Hooper's letter weights, 88.
Hydraulic Works, *vide* Harbour, River, Canal, Pier, Dock, Water, Pump, Drainage.
———— Algiers, 265; aqueduct at Dijon, 398; balance gates, 42; coffre dam, Neville on pressure of water, 78; ditto, houses of parliament, 283; Dagenham breach, stoppage of 106; draining, Fleet sewer, 398; ditto, Fiskerton, 362; ditto, Haarlem lake, 327; ditto, Lough Foyle, 346;

embankment near the Medway, 258; ditto, Morecambe Bay, 71; ditto, Thames, 258, 359, 383; land-springs, 120; Lough Erne, 343; Loughs Foyle and Swilly, 346; mortar, 266; piling, 29; puddling, 30.
Institute of Civil Engineers, 97, 133, 211, 248, 282, 314, 346, 384, 423.
Iron, anthracite, Ystalyfera, 342.
—— coach, 327; corrosion by water, 424.
—— corrosion, Neilson's patent, 363.
—— ditto, Wall's, 429.
—— history of, 390.
—— lower deck beams, 398.
—— malleable, in Persia, 296.
—— manufacture, Guest's improvements in, 396.
—— pillars, experiments on, 248.
—— schooner, 397.
—— steam boats, 37, 69, 104, 177, 211, 212, 252, 288, 292, 325, 348, 362, 388, 397, 398.
—— strength of, for ship building, 388.
—— water and air, action on, 387.
Jackson, G. B. W., on computing earthwork, 413.
King's College, 426.
Lardner, Dr., lectures on railways, 128, 168.
Leeds, table of architects, 112, 140, 147, 183.
Lighthouse, Wyre, screw pile, 132, 181, 229, 251, 322; lights for, 283.
Lime, 176, 266.
Limekiln, Menteath's, 176.
Limestone, 309, 340; blasting, 165; in Ireland, 198.
Lough Erne improvement, 343.
Locomotive Engines, *vide* Steam Engine, Carriage.
———— adhesion of the wheels of 18; alarum, 322; American, 289, 347; common road, 254, 280; Great Western, 168, 178; Hancock's, 280; Hull and Selby, 427; London and Birmingham, 315; manufactory, 32; power, 101, 168; Rudge's, 364; wheels, 357; wheel, wood tyre, 386; ditto, metallic, 401.
Machine, *vide* Steam Engine.
——— Brick, 160, 175, 184; cannon boring, 172; draining, 412; gunpowder, proving, 21; ground-rope, 87; planing, 172, 291; plough, steam, 160; propeller, 25, 49, 157, 292, 397; pump, 26, 273, 363; refrigerator, 211; saws, 26; screw jack, 50, 386; shot, 363; turbine, 420; washing, 28, 90.
Manufacture,—Gilding metals by electricity, 277; glass, 217, 258, 276, 316, 346, 373; iron, 37, 69, 104, 177, 211, 212, 248, 288, 292, 296, 325, 327, 342, 348, 362, 387, 388, 396, 397, 398; lime, 176, 266; papier mâché, maps, 201, 286; paper, 396; patent felt, 367.
Memorial, *vide* Column, Statue.
——— Chatterton, 105; Neale, 288.
Mica, use of, instead of glass, 346.
Mining, *vide* Geological Society, Lime, Coals, Iron, Stone, Gas.
——— asphalte, artificial, 215; blasting limestone, 165; burning coal mines, 179; coal, India, 216; iron, 390; lead, 284; limestone, 165, 176, 198, 266, 309, 340; mines, 99; Persian iron, 297; raising water, 419; Rayas, 352; safety lamp, 36; slate, 73.
Monument, Napoleon, 406.
Monument, *vide* Memorial.
Moorsom, Capt. W., on embankments, 406.
Mornay, A. A., on railway curves, 15; on the theory of the steam engine, 59, 149.
Neale testimonial, 288.
Nelson column, 178, 211, 327, 355, 379.
Paper manufacture, Martin's, 396.
Papier mâché maps, 286; ornaments, 201.
Parliament, proceedings in, 69.
Parris's, Mr., decorations, 278.
Patent, Sharp's, 428.
Patents, 27, 40, 72, 104, 139, 175, 180, 216, 256, 292, 328, 364, 400, 429, 431.
Pavement, wood, 67, 164, 215.
Pedestal, Hyde Park Corner, 362.
Peppercorne, Mr., 256.
Pier, *vide* Hydraulic.
—— Aberdeen, 29; Algiers, 265; Granton, 324; Margate, 37.
Planing machine, Rennoldson's, 291.
Porcelain letters, 176.
Pott's picture hanging, 400.
Power, improvement in obtaining, Poole's, 314.
Poynter, A., on arabesque, 94.
Pump, *vide* Valve.
—— Gravel, 26.
—— Rotatory, Sutcliffe's, 273.
—— Stuffing box, Horne's, 363.
Puzzolana, 266.
Railway, *vide* Locomotive, Carriage.
——— Act for regulating, 381; American, 430; Altona and Lubeck, 308; atmospheric, 164, 253, 259, 379; Belgian, report on, 288; Birmingham and Gloster, 38, 139, 214, 289, 399, 406; Blackwall, 38, 178, 213, 290; bridges of timber, 358, Brighton, 38, 103; Bristol and Exeter, 213; Cheltenham and Great Western, 214, 254; Croydon, 38, 137; curves, 15, 74, 128, 169, 385; curves, effect of, on carriages, 267; dial, 397; Dublin and Drogheda, 398; Dundee and Arbroath, 70; Eastern Counties, 38, 290; economy of, 422, Edinburgh and Glasgow, 70, 179, 289; fares, 278, 311, 376; friction dynamometer, 384; French, 254; Glasgow and Ayr, 38, 215, 290; Gloucester and Newport, 430; gradients, 168; Grand Junction, 38, 168; Great Western, 38, 71, 103, 168, 178, 179, 290; Great North of England, 71, 231, 254; Greenwich, 103, 430; gronnd rope apparatus, 87; Hull and Selby, 38, 70, 245, 289, 290; Lancaster and Preston, 178, 215, 290, 326; Lardner's, lectures on, 168; Llanelly, 254; London and Birmingham, 71; London and Dublin, report on, 190; London and Norwich, 398; management, 414; Manchester and Birmingham, 139, 178, 214, 290; Manchester and Leeds, 39, 103, 399; Maryport and Carlisle, 70, 290; Midland Counties, 139, 179; North Midland, 38, 103, 178, 214, 289; North Union, 326; Northern and Eastern, 214; Paris and Rouen, 215; pneumatic, 164, 253, 398; power, employed upon, 6, 63; Preston and Wyre, 214, 256, 290; Rangeley's 322, 372, 388; report of select committee, 137. 278; rope traction, 6, 213, 393; into Scotland, report, 241; screw jack, 386; Sheffield, and Manchester, 6, 70, 178; sleeper, cedar, 346; South Eastern, 2, 39, 179, 430; South Western, 71, 103, 215; speed on, 265; Taff Vale, 398, 430; telegraph, 279, 323; Thames Haven, 430; traffic, 278, 311, 376; trains, stopping, 429; water, power on, 393; West Cumberland, 241; West London, 164, 253, 398; wheel, Dirck's, 401; working expenses of, 174; York and North Midland, 290.
Ralph's Review of the Public Buildings of London, 199, 227, 263, 302, 339.
Rambles by Philomusæus, 4, 84, 155.
Refrigerator, Davison's, 211.
Report on harbours (South Eastern Coast) 236, 259, 321.
——— plans for preventing steam vessel accidents, 245.
——— railways, 137, 278.
————— London and Dublin, 190.
————— into Scotland, 241.
————— Belgian, 288.
——— steam navigation, France, 360.
——— Thames embankment, 382.
——— Trafalgar-square, 255, 286, 304.
Retort upon retort, 259.
REVIEWS—Architectura Domestica, 33; Bartholomew's specifications, 319; Bielefeld's papier mâché, 130; Brees's Railway Practice, 276; Brees's Glossary of Civil Engineering, 276, 393; brief description of plans for supplying water to the metropolis, 203; Bruff's Engineering Field Work, 317, 354; Claxton's Memoir of a Mechanic, 31; Comic Latin Grammar, 34; Companion to the Almanac, 32; Cooley's Propositions, 130; Cooley's Euclid, 34; Cresy's Stone Church, 318; Creuze's Naval Architecture, 250, 277; Day's Parallels, 250; Egerton's Mexico, 351; France's Geology, 317, 394; France's Trignometrical Surveying, 34; Gandy and Baud's Windsor Castle, 250; Gilks's Wood Engraving, 130; Hann's Theory of Bridges, 29; Heath's Picturesque Annual, 131; Kittoe's Illustrations of Indian Architecture, 203; Loudon's Arboretum, 102; Manchester as it is, 32; Mushet's Papers on Iron and Steel, 317, 390, 414; Nicholson's Guide to Railway Masonry, 34; ditto, Treatise on Projection, 250; Ornamental Gates of the Parks, 34; Pambour's Locomotive Engines, 415; Parkes on Steam Boilers, 100; Page's Guide to Ornamental Drawing, 130; Penny Cyclopedia, 203, 389; Practical Inquiry into the Laws of Excavation, 391; Radford's Construction of the Art, 174; Reid's Chemistry, 250; Rendel's Plymouth Railway, 393; Repton's Landscape Gardening, 52; Ricauti's Rustic Architecture, 207, 393; Richardson's Architectural Remains, 276, 320; Robert's Galvanism, 393; Rooke's Geology, 250; Royal Lodges, Windsor Park, 102; Scott's Practical Cotton Spinner, 393; Standish's Seville, 351; Tredgold's Elementary Carpentry, 102; White's Harbours of Refuge, 102; Wightwick's Palace of Architecture, 352; Year Book of Facts, 130; Young's Practical Arithmetic, 174.
River Erne, 343; improvement of, 284; Medina, 37; New, 291; Shannon, 288; Severn, 31; Thames, 258, 283, 359, 382; Trent, 398; Vistula, 210, 229.
Road, Perth to Elgin, 37; profile of, 385.
Royal Society, 22, 69, 93, 207, 247, 281.
Safety beacon, Bullock's, 345.
Saws, circular, 26.
Scientific Society, 426.
Screw jack, traversing, 50, 386; universal, 386.
Sculpture, Newton's, copying machine, 429.
Sea, depth of, 55.
Sewer, Fleet, 398.
Ship-building, *vide* Steam-boat, iron lower deck beams, 398; French, 277; sliding keels, 349; iron, 388, 397; mast carrying, 430; form of vessels, 421.
Shot machine, 363.
Smoke, consumption of, 356.
Society of Arts, 10.
Statues, stone and bronze, comparison of, 355; Huskisson's, 86.
Steam as a moving power, 426.
Steam Boat, *vide* Steam Engine, accidents, 163; Archimedes, screw, 192, 252, 325; Alice, iron, 69; American, 117, 162; Atlantic. 37, 213, 361; Australian, 397; Brigand, iron, 288; British Queen, 37, 153, 177, 213, 325; canal, 398; Clyde, 430; Courier, iron, 212; Cyclops, 36; Dover, iron, 252; Duchess of Lancaster, 252; dredging, 430; Dahlia, iron, 325; Earl of Hardwicke, 325; East Indian, 286; Eclipse, iron, 292; Elbe, 212; Elberfeld, iron, 325; engineers, 69; engine, 73, 142, 153, 157, 159, 172, 212, 245, 358, 374, 385, 386; Enterprise, iron, 37; Father Thames, iron, 362; Ferry, 398; fire, extinguishing, 357; Fire King, 251; France, report on, 360; German, 213; Great Western, 3, 70, 153, 158, 213, 398; India, 325, 348; iron, 37, 69, 104, 177, 211, 212, 252, 288, 292, 325, 348, 362, 388, 397, 398, 430; ditto, durability of, 211; ditto and timber, comparison of, 348; ditto, testing of, 101. Junius Smith, 400; Lee, iron, 177; Liverpool, 213, 253; Mermaid, iron, 430; Mail, 177; Monarch, iron, 430; Mongebelle, 398; Nemesis, 70, 137, 348; Nonsuch, iron, 314; Oriental, 253, 325; Orwell, iron, 37, 104, 212. Paddles, Boulton's, reefing, 76; ditto, Hall's, reefing, 76; Peru, 287, 362, 398; Phlegethon, iron, 252; Polyphemus, 397; power for long voyages, 386; President, 70, 173, 176. Propeller, 397; propellers, experiments on, 25, 49, 157; ditto, new, 292, 430; Proserpine, 104; Pylades, 37; Queen Victoria, 212; Rose, iron, 397; Royal Mail, 253; Ruby, 251; sliding keels, 349; smoke, 170; Sons of the Thames, iron, 37, 104, 177, 212; Swallow, iron, 235; Swedish, 177; Thames floating engine, 325; Thistle, iron, 397; tug, 287; United States, 173; Vernon, 325; Warrington, iron, 430.
Steam Engine, *vide* Fuel.
———— boiler, Curtis's, 76; ditto, Poole's, 175; ditto, proving, 430; ditto, Moindron's improvement, 327; ditto, clothing, cedar, 346;

ditto, ditto, patent felt, 367; ditto, incrustation, 397; ditto, water regulator, 291, 328.
———— condensation, 358; Cornish, 4, 133, 153, 282, 419; ditto, and Lancashire system of working, 4; Craddock's improvement, 396; East London Water Works, 7, 65; epicycloidal, Clark's, 87; explosion, prevention, 385; factory, French, 400; fires, lighting, 363; friction, 375; fuel, 134, 176.
———— furnace, Moore's plan for feeding, 162; ditto, smoke consumer, 216.
———— Huel Towan, 314; indicating power, 127; manufactory, Fawcett and Co.'s, 172; Fairbairn's, 32.
———— marine, 73, 142, 153, 157, 159, 172, 212, 245, 358, 374, 385, 386; ditto, Maudslay and Field's, 73, 157; ditto, trunk, Broderips's, 142, 159; ditto, ditto, Humphry's, 142, 159; ditto, employment of expansive principle, 153; ditto, oscillating, 212; ditto, accidents, report on, plans for preventing, 245; ditto, temperature of condensation, 358; ditto, long and short stroke, 374; ditto, power, 386; ditto, Alice, 385; ditto, Seaward's, 374; ditto, connecting rods, 424.
———— power, 28, 65, 100, 127, 170; rotary, 397; ditto, Moore's, 158; safety valve, 216, 251, 359, 385; smoke, consumption of, 216, 356.
———— theory of, by Mornay, 59, 149; vacuum, 164.
Steam fire engine, 431.
—— plough, 160.
Steam shot machine, 363.
—— solubility of silica by, 282.
—— vessel inquiry, 85, 108, 163.
—— washing machine, 28, 90.
Stone, bendable, 183.
—— new Houses of Parliament, 189, 309, 340.
—— Talacre, 209.
Storms, effect of fire in preventing, 39.
Survey, trigonometrical, 366, 431.
Surveying, azimuth cap, 315.
——— calculating balance, 21.
——— chain, Hindle's, 310.
——— change of pins, 379.
——— computation scale, 324, 379, 405.
——— copying drawings, 354.
——— irregular plots, instrument for, 55.
——— level, Browne's, 283.
——— poles, Dempsey's, 108.
——— railway curves, 15, 74, 128.
——— roads, profile instrument, 55.
Sang's hypsometer, 403.
Thames Tunnel, 216, 249.
Theatre, Adelphi, 394; Hanover, 162; machinery, Stephenson's, 363; Princess's, 394.
Tide gauge, 342, 394.
Tides of the ocean, 229.
Timber, dyeing, 183; effects of worm on, 424; felling, 341; prevention of decay of, 26, 27, 328; white cedar, 346.
Tottie, C., on the Napoleon monument, 406.
Turning, 172, 175.
Valve cocks, Topham's, 121.
Varnish of dextrine, 25.
Vessels, form of, 421.
Voltaic engraving, 35.
Walls, iron ties, experiments on, 41.
Warming and ventilating buildings, 358.
Water, *vide* Hydraulic, Steam Engine, Well, Pump.
——— Bourne, 103.
——— balance gates, East London Water-works, 42.
——— company, new, 250.
——— filter, 207.
——— plans for supplying the metropolis, 207.
——— power, application of 291.
——— raising engine, Adcock's, 279, 299.
————————— Brighty's, 291.
————————— Cornish, 419.
————————— De l'Osier's, 51.
————————— Fairbairn's, 412.
————————— Hall's, 128.
————————— Harvey & West's, 41.
————————— Jeffrey's, 386.
——— Thames, analysis of, 192.
——— Weir, Broomielaw, 415.
——— wheel, vertical, Curtis's, 129.
Wells *vide* Artesian, 99.
Whitworth on surfaces of metal, 421.
Wicksteed on the supply of water to the metropolis, 10, 45; and the balance gates of the East London Water Works, 42.
Williams, C. W., on the combustion of coal, 412.
Wire fences, 48.
—— rope, 431.

INDEX TO PLATES AND ENGRAVINGS.

Ashton Court, 52.
Balance gates, 2 plates, 42.
Bank, London and Westminster, 1 plate, 73.
—— Savings, Finsbury, 217.
—— Union, 183.
Beams, trussed, 6 cuts, 161, 322.
Bielefeld's papier maché works, 8.
Boulton's reefing paddles, 2 cuts, 74.
Brick machine, Bakewell's, 160.
———— White's, 8 cuts, 184.
Bridge, Ardrossan, 29.
——— East London Water-works, 2 plates, 42.
——— iron, 162.
——— James River, 1 plate, 125.
——— Suspension, Dredge's, 1 plate, 193.
——— Victoria, Bristol, 193.
Buttresses, 4 cuts, 365, 366.
Capitol, Washington, 293.
Cathedral, Athens, 2 cuts, 220, 221.
———— Avignon, 2 cuts, 143, 144.
———— Freiburg, 329.
———— St. Paul's, 2 cuts, 329, 330.
———— Salisbury, 329.
Chapel, King's College, 329.
——— Unitarian, Dukinfield, 1.
Chatterton's monument, 3 cuts, 105.
Church, Arles, St. Trophime, 144.
——— Bow, 329.
——— Caen, St. Peter's, 322.
——— Mone tes Koras, 221.
——— Panagia Lycodimo, 220.
——— Poitiers, Notre Dame, 221.
————————— St. John, 144.
Church Ravenna, St. Vital, 219.
——— St. Bride's, 329.
——— St. Dunstan's East, 330.
——— St. Genevieve, 293.
——— Sergius and Bacchus, 220.
——— Stone, Kent, 8 cuts, 318.
——— Tours, St. Martin's, 143.
Cobham Hall, 53.
Cofferdam, 7 cuts, 79, 80, 81, 82, 83.
Column, General Clayton's, 181.
Cornice, Reform Club, 336.
Curtis's boiler, 2 cuts, 76.
——— ground-rope apparatus, 3 cuts, 87.
——— railway truck, 3 cuts, 5.
Custom-house, Liverpool, 3 cuts, 410.
Dempsey's surveying-poles, 3 cuts, 108.
Dublin Bay, 146.
East London Water-works, 2 plates, 42.
Electric telegraph, 323.
Elizabethan shop front, 1 plate, 257.
Embankment, Thames, 258.
Fairbairn's draining machine, 412.
Harbour, Ardglass, 146.
——— Beachy Head, Dover, Foreness, 1 plate, 240.
——— Kingstown, 146.
——— Lowestoft, 147.
——— Portrush, 146.
Hooper's letter weights, 88.
Iron furnace, Persian, 7 cuts, 296.
—— ties in party walls, 2 cuts, 41.
Lewis, 30.
Merchant Seamen's Institution, 1 plate, 251
Minaret, Armedabad, 329.
Pantheon, interior, 1 plate, 195.
———— Rome, 293.
Pavilion, Brighton, 53.
Piling, Telford's, 2 cuts, 29, 30.
Polytechnic Institution, 1 plate, 293.
Public road, 2 cuts, 54.
Pump, rotary, Sutcliffe's, 7 cuts, 273.
—— valve, Harvey & West's, 1 plate, 41.
Quay, Aberdeen, 29.
Railway, atmospheric, 1 plate, 260, 4 cuts, 407, 408.
——— Rangeley's, 1 plate, 372.
——— wheel, Dirck's, 5 cuts, 401.
Reform Club, 141, 4 plates, 336, 409.
Repton, portrait of, 52.
Safety valves, 2 cuts, 251.
Sang's hypsometer, 4 cuts, 404.
Ship-building, 5 cuts, 349.
Slide valve cocks, Topham's, 4 cuts, 121.
Steam-engine, Broderip's trunk, 2 cuts, 142.
————— Clark's, 2 cuts, 87.
————— Maudslay's Two Cylinder, 2 plates, 73, 2 cuts, 157.
————— rotary, Moore's, 148.
Surveyor's scale, new, 354.
Traversing screw jack, 50.
Warwick House, Birmingham, 1 plate, 104.
Water engine, Adcock's, 3 cuts, 299.
————— De l'Osier's, 1 plate, 51.
——— filter, 2 cuts, 203.
——— wheel, Curtis's vertical, 3 cuts, 129.
Wire fences, 6 cuts, 48.
Wyre Lighthouse, 182.

DIRECTIONS TO BINDER.

Plate 1.—Harvey and West's Patent Valves	opposite page	41
„ 2 & 3.—East London Water Works	„	42
„ 4.—De L'Osier's Apparatus for Raising Water	„	51
„ 5 & 6.—Maudslay and Field's Improved Steam Engine with two cylinders	„	73
„ 7.—London and Westminster Bank	„	84
„ 8.—Bridge over the James River in Virginia	„	125
„ 9.—Warwick House, Birmingham	„	128
„ 10.—Dredge's Suspension Bridge	„	193
Plate 11.—Pantheon, Oxford Street	opposite page	201
„ 12.—Harbours of the South Eastern Coast	„	237
British Seamen's Hospital	„	251
„ 13.—Shop front in Oxford Street	„	257
„ 14.—Clegg & Samuda's Atmospheric Railway	„	260
„ 15.—Polytechnic Institution	„	321
„ *15 & 16.—Reform Club House	„	336
„ 17.—Rangeley's Rotation Railway	„	372
„ 18 & 19.—Reform Club House	„	409

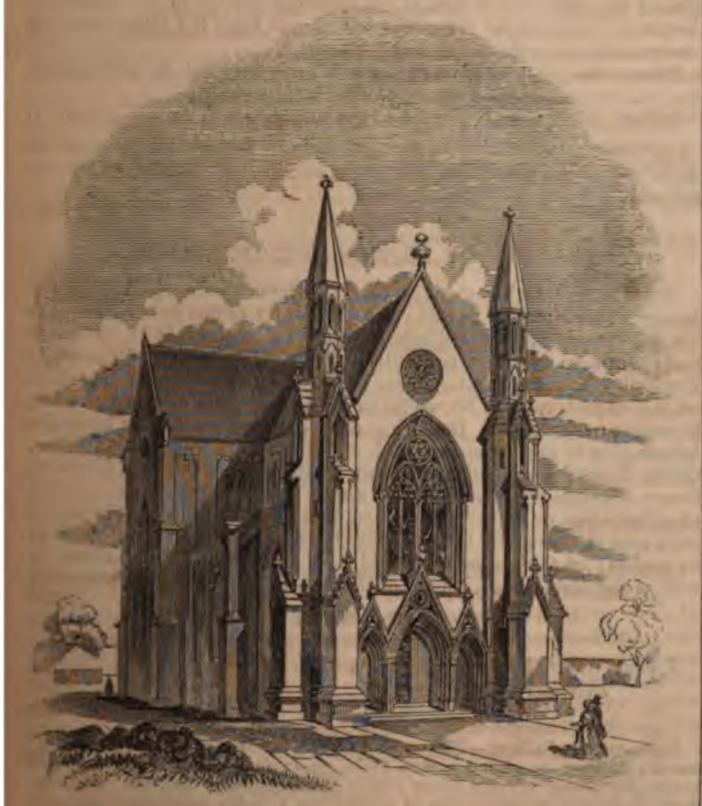
THE

CIVIL ENGINEER AND ARCHITECT'S

JOURNAL.

PRESBYTERIAN (UNITARIAN) CHAPEL AT DUKINFIELD.

MR. R. TATTERSALL, ARCHITECT.



ECCLESIASTICAL EDIFICES.

It is our intention under this title to give illustrations and descriptions of such new edifices dedicated to religious purposes, respecting which we can obtain information. We hope that this may serve as a stimulant in directing public attention to this now neglected subject, and particularly in rousing the self-esteem of members of the establishment. At present those entrusted with the erection of churches seem to consider it their first object to make as much pew room as possible, regardless of all other objects, on much the same principle as they would construct sheep pens—crowd the animals in, and care nothing for their comfort. Why does the church appeal so powerfully to the beautiful monuments built by our ancestors, why does she depend on that devotional feeling which the contemplation of our hallowed sites suggests, if she herself thinks it beneath her to keep up the dignity of the estate she has inherited. Oh! how eloquently can her ministers dwell on the solemn thoughts inspired by the long drawn aisles of our ancient cathedrals, how energetically can they remind us of our childish predilection for the ivy covered spire! but when it comes to the expenditure of the vast sums under their control, how totally do they neglect their favoured dogmas, how selfishly do they consult their own interests at the expense of the establishment of which they are members! Empirics are employed, the men who can do the dirty work cheapest, nothing is allowed for architecture, nothing for the decorative arts—the worthy pastors think they best consult the wishes of their flocks by making the sheep pens as numerous as possible. They totally forget that it is not their own money they are expending, but the produce of public grants or private benefactions; that they are only trustees, and that they are not to look to their own interests only, but pay some regard to the purposes for which the sums were received, for surely it is more gratifying to the donors to see a handsome edifice rather than the barn-like structures with which the public have been of late so abundantly annoyed. A Union Workhouse would beat most of the new churches hollow in almost every point of its construction. We can only say that unless the members of the establishment reform their system, they will be beaten by the other religions, Jews, Catholics and Dissenters all surpass them in elegance and costliness of construction, and surely their necessities are not less, nor their revenues more abundant. We regret indeed that one of our first examples, the Unitarian Church at Dukinfield, should be the work of Dissenters, and a shame to the dispensers of the public money. Sure without any parliamentary funds, without any rich endowments, and with but a small portion of the wealth of the nation, first rate talent has been employed, and a noble monument erected.

No. 28.—Vol. III.—January, 1840.

DUKINFIELD CHAPEL.

This chapel is now erecting on the site of the former edifice, (whose dilapidated condition and inadequacy in supplying room for the large congregation assembling therein, rendered the erection of a new and more commodious building absolutely necessary,) from the designs of Mr. R. Tattersall of Manchester.

The style of architecture which has been adopted for the structure now in progress, is that which prevailed at the commencement of the fourteenth century, when our architects began to add refinement in the details to the many beauties which characterise their works, and to introduce those changes in the early English style which immediately precede and ultimately form and distinguish the decorated style.

The plan of the chapel is cruciform, with a lofty nave and transepts lighted by clerestory windows, the nave having aisles lighted by lancet windows. The east and west ends of the nave project beyond the ends of the aisles; in the west projection are the principal entrances with a children's gallery over, whilst the east projection contains the vestry and private entrance with a gallery over affording ample room for a powerful organ and numerous choir.

The principal elevation into which it has been thought advisable to introduce whatever decoration might be used, consists of two octagonal turrets flanking the west wall of the nave, strengthened by massive double buttresses in three stages, the lower part terminating in weathered canopies, the middle having weathered offsets, and the upper being formed into niches, surmounted by canopies, uniting with the weathering of the turrets, and the parapet moulding of the west gable. The lower and upper canopies to the buttresses, are terminated by appropriate finials. At the termination of the buttresses the turrets become isolated and are continued in two stages to the base of the pinnacle, the lower stage having shafts at the angles with moulded bases and capitals supporting pointed arches, and in each face of the octagon is a narrow slit or opening in the form of the ancient *ballistraria*, whilst the upper stages have plain shafts at the angles, with a narrow lancet opening, having the tooth ornament in the hollow surrounding the same, on each face of the turret. The turrets finish with lofty pinnacles having shafts at the angles, and terminating in finials, the highest part of which will be 73 feet above the surface of the ground. One of these turrets will contain a bell, and the other is to serve for the clock weights. The turret in which the bell is to be suspended will contain a winding staircase for access to the clock-room in the roof the nave.

Between the turrets to the west front are three doorways forming the principal and gallery entrances to the chapel. These are boldly recessed, the centre door being much wider than the side ones, and are formed into one group by the arrangement of their shafted joints, moulded archivolts and the triangular canopies with which they are surmounted. The moulding over each canopy, unites with the hood moulding of each door, and terminates upon carved heads, whilst the apices of the canopies finish with carved finials, the centre one being quite isolated in the opening of the window over. Each canopy is filled in with deeply cut tracery. In the hollows of the arched heads and between the shafts of the jambs, it is intended to introduce those very effective enrichments, known as the ball flower and leaf ornament and the tooth ornament. The three doors will be of oak, relieved by the quaint and beautiful ramified iron scroll-work so characteristic of this style of architecture. Immediately over the doors is a four light window formed with shafted mullions and jambs, and filled in with the rich and elegant tracery, which we find immediately preceding the flowing lines of the decorated style. The ball flower and tooth ornaments will be introduced into two of the hollow mouldings of the jambs and head, and the window will have a hood moulding terminating on carved heads. Above the window, and in the gable of this front will be placed the clock dial, which it is intended eventually to make transparent. This is in the form of a multifoil surrounded with bold mouldings, and in the intervals of the cusps will be placed the figures of the dial. The gable of this front which is very lofty, (as are all the others owing to the high pitch of the roof), is surmounted by a richly carved finial, and in the mouldings of the parapet the ball flower ornament is again introduced. The whole of the plain ashlar to this front is to be neatly tooled, but the moulded work and dressings are to be rubbed or polished. The remaining fronts of the building are of a much plainer and simpler character, and are to be faced with neat hammer dressed walling stones, the dressings being tooled. All the exterior of the chapel is to be faced with the best Yorkshire stone.

The sides of the aisles are divided into compartments by buttresses of an early character, having a single off-set, and uniting at the top with the parapet, which is supported between them by quaintly cut corbels, and finishes with a tablet or coping formed by the moulded cast-iron gutter. In each compartment of the aisle are plain lancet windows, with neat hood moulds terminating on carved heads. The transepts project some little beyond the sides of the aisles, and there external angles, as well as those to the east end of the nave, are flanked by plain buttresses of a similar character to those of the aisles, and divided into three stages with plain off-sets. The three gables are covered by a plain coping, terminating in canopies at the lower ends. In the gables to the transepts and east end of nave are openings for light and ventilation to the roof, and the same kind of corbels are introduced to support the parapet as are used to the aisles. In the end of each transept are triple lancet windows united together by their hood mouldings, the centre being higher than the side ones. The clerestory is divided into compartments by flat buttresses ranging with those to the aisles, surmounted by a parapet and coping of a similar description to those already mentioned. In each compartment are triple lancet windows having hood mouldings terminating on carved bosses. The principal entrance door opens into a porch or vestibule formed between the two staircases to the galleries, from which it is separated by screens ornamented with tracery, and having doors of communication. From hence, inner folding-doors open directly into the body of the chapel, which is divided as before described into nave and transepts, the former being flanked by aisles from which it is separated by light piers formed of clustered shafts, supporting on richly moulded pointed arches the clerestory walls, in which there is a narrow lancet window over each compartment. The aisles are also open to the transepts from which they are separated in like manner. The galleries will extend across the west end of the nave over the aisles and across the transepts. The nave and transept ceilings are to be groined throughout with moulded ribs on all the intersections of the vaulting, and against the walls, springing from corbels formed by clustered shafts affixed to the clerestory walls. The ceiling to the aisles is to be formed into neat plain panels. A neat screen extends across the east end of the nave in a line with the ends of the aisles, separating the vestry from the chapel, against which is to be placed the pulpit, to be entered from the vestry through an opening therein. The pulpit will have a highly enriched canopy or sounding board, and the whole is made to harmonize with the screen and the general character of the building. Around and beneath the pulpit, which is supported by a cluster of shafts, is the space allowed for the communion altar on a raised platform enclosed by a neat railing. Beyond the screen and over the vestry is the organ gallery, and it is intended that the front of the organ-case shall be made to assimilate with the screen as much as possible. At the opposite end of the nave, and over the principal entrance is a gallery capable of containing upwards of seventy children, leaving an uninterrupted view of the four light window in the west front. Vaults are formed under the west entrance, and there is a cellar under the vestry for warming the chapel with hot water.

The extreme length of the building will be 94 feet, and the width across the nave and aisles 50 feet, that across the transepts 61 feet.

The chapel will contain sittings for 977 persons, 194 of which are free. It is expected that it will be completed and ready for divine service towards the latter part of this year. The cost of its erection will be defrayed by subscription.

HISTORY OF BRITISH ARCHITECTURE.

MR. EDITOR—Being anxious to make myself acquainted with the history of architecture in this country, I regret to find how inadequate are the records hitherto collected by writers on the subject, to enable one to form an accurate conception of the vicissitudes of the art in England. This has excited in me the desire to collect such materials on the subject, as may be useful to my professional brethren. I beg therefore to appeal Sir, through you, to all parties who may have any information to give of men of such standing as Vanburgh, Hawksmoor, Gibbs, Carr of York, Morris of Bath, Kent, Gandon, Taylor, Chambers, Dance. I shall feel much obliged either by being referred to sources of information, or by being furnished with the lists of the works which such men as these may have executed. I of course confine myself to no period; on the contrary, I would wish to embrace the earliest, as well as the most recent, epochs of the history of English Architecture.

I am, Sir, very faithfully, your's,

THOS. L. DONALDSON.

7, Hart Street, Bloomsbury Square,
December 20, 1839.

South-eastern Railway.—The rapid progress of the works of the South-eastern Railway is giving quite a lively aspect to Folkestone. The bridge across the Canterbury and Dover road is also completed; and the advancement of the line on either side is going on in a highly satisfactory manner. —*Dover Chronicle.*

CANDIDUS'S NOTE-BOOK.

FASCICULUS XII.

"I must have liberty
Withal, as large a charter as the winds,
To blow on whom I please."

I. FROM all the views and drawings I have ever seen of Abbotsford, I always considered it to be a very trumpery specimen of architecture, but I was not before aware of the exceedingly whimsical taste of Sir Walter Scott, until I saw the view of the dining-room given in the ninth volume of Lockhart's Life of him now publishing. Will it be believed that that dining-room contains one of the oddest and most impertinent pieces of furniture imaginable for such an apartment? Had it been a Rumford cooking apparatus or something of that kind, its convenience might have excused its oddity and homeliness, but what shall we say to a four-post bedstead in a dining-room? There certainly is no accounting for tastes; and the idea is a sufficiently original one. Perhaps it was intended as a refinement on the Roman mode of lying recumbent at table upon couches. But I trust that no one will think of imitating Sir Walter in that particular fancy of his, or people will henceforth strip and get into bed, instead of sitting down, to table. At least that should be a privilege exclusively confined to persons of genius,—not extended to ordinary mortals, good reader, like you and me. Well, there certainly must have been comical doings at Abbotsford, if such was the custom of the place: and we insignificant nobodies may be very well content with dining-rooms without beds in them.

II. The Abbotsford dining-room reminds me of the Scott Monument at Edinburgh. How is that getting on?—or how happens it that we hear no more about it? Is it, like the Edinburgh Parthenon, the monument of a monument that was to have been; or like the Nelson Monument in Trafalgar Square, altogether an imaginary, immaterial fabric, Certes, monuments are not things of mushroom growth.

III. We are, now it seems, all at once going to be filled with admiration of Inigo Jones; which is passing strange, considering that they abound with the very faults that are found unindurable when they occur in modern buildings. With what consistency of taste, those who are shocked at the impropriety of half columns and broken entablatures, can affect to see any supereminent beauty in his building at Whitehall, which has the further impropriety of an upper order above a lower one,—it is for them to explain. Possibly,—since they cannot but allow that the circumstances just referred to are egregious defects in themselves, they will assert that there are merits and excellences in his designs which amply atone for all their blemishes,—not to call them vices. That such is really their opinion must be taken for granted; but then, wherefore do they not vindicate themselves from the appearance of inconsistency, by plainly discriminating between the defects they reprobate and the beauties they admire, and informing us in what the latter consist? Or are we to suppose, that they are of the sort of critics extolled by Sterne for being pleased they know not why, and care not wherefore;—for which in my opinion no very great power of criticism is required? Perhaps Sterne was thinking at the moment, only of the kind of critics he himself wished for,—and there are others besides him, who look more to the quantity than the quality of the praise they get, but for my own part I would rather obtain the approbation of one critic who could tell why he bestowed it, to that of a score of others whose compliments seem to have no meaning, consequently carry with them no proof of sincerity.

However correctly and exactly general principles may be laid down, they can never be made to comprehend every specific application of them: but there will invariably be, more or less, something that, although based upon them does not obviously appear to conform to them, may perhaps may seem at variance with them, on which account those who are not acquainted with the mysteries of art, becomes perplexed, and are at a loss to know whether they ought to censure or are at liberty to admire. It becomes the duty of criticism, therefore to elucidate such apparent contradictions, and in every particular case, to explain how it happens that the disregard of certain established rules may have been attended with beauty, or, *vice versa*, how the adherence to them has failed to secure it:—again, to point out wherein frequently consists the very great difference between two buildings, very similar as to style and design, yet altogether unlike in regard to the impression they make.

IV. Very far more stress than ought to be, is generally laid upon simplicity of plan. For my own part, I very much question it being a merit at all, when I perceive that so far from conducing to any beauty, it generally constitutes a defect, inasmuch as it excludes all variety and combination, together with contrivance. While it leaves nothing to the imagination, it does not present itself to the eye as a beauty the entire plan not being seen at once; nor do I understand what particular pleasure can be afforded to the mind, by knowing that with regard to the distribution and form of the several rooms there is nothing more than what has been seen over and over again. Nay, I will not be quite sure that I understand what is meant by simplicity in such cases: yet if it be meant that the plan is such that any stranger can at once comprehend every part of it, by merely going over the building at a single time, should say that so far there would be very little to approve or admire;—certainly no evidence of skill or ingenuity, and very little of either picturesque effect, contrast or variety, because where they do not result almost entirely from accident, they are produced by a study which aims at something more than mere simplicity of plan. While the latter tends to make a large house seem smaller than it is, a certain degree of intricacy and complexity causes a moderate sized one to appear considerably larger, especially where the arrangement is such that rooms may present themselves unexpectedly after we suppose that we have gone over the whole. Still there are limits to be observed: complexity ought not to be carried to perplexity; but some degree of the former greatly heightens every other merit.

V. It is odd; but now after the abuse thrown upon the poor National Gallery, because the rooms are no bigger than closets,—disgracefully confined and mean, some one starts up and assures us that they are utterly unfit for their purpose, because they are very much—*too large!* So at least says a writer in Blackwood's Magazine, who contends that spacious and extensive galleries, such as that of the Louvre are utterly unfit for showing pictures as they ought to be seen; and that the collection should be placed in small rooms,—not more than three or four paintings in each. This is surely running quite into the other extreme; but there certainly can be no doubt that as far as enjoying pictures themselves, and not the display of a parade of them, is the object, it is best obtained by hanging them so that each when looked at can be distinctly seen and examined, with nothing to distract attention from it.

VI. How people can reconcile themselves to windows without dressings in buildings where any degree of ornament or finish in other respects, is aimed at, is almost incomprehensible. Not even on the plea of economy has any one yet thought of entirely omitting capitals to columns, though it might be done with as much propriety and consistency; for if a window will answer all the necessary purposes of one, whether it be a mere aperture in the wall, or one properly defined and finished by its own architectural border,—so also will a column answer its purpose equally well, whether the top of it be fashioned as an ornamental member of it or not. Nor would it, though certainly more remarkable, be more solecistical and contrary to architectural principle to introduce columns without capitals among dressed windows, than naked windows among well dressed columns. Or if there be any thing to render the latter, and more common mode less preposterous than the other would be, it is because the columns themselves are generally quite superfluous, therefore were their decoration to be omitted, they might be dispensed with altogether. But then, on the other hand, so much the more absurd is it to have recourse to columns at all—at least for decoration,—under circumstances which forbid not only corresponding embellishment, but even ordinary finish in any other respect. Next to omitting window dressings entirely, is the fault of making them so poor and plain as to be hardly visible, as is the case in many of our modern Greek buildings, in which the dressings to the windows consist of a mere border distinguished by an insignificant moulding around it, so as to occasion equal sameness and insipidity.

The Great Western Steam-ship.—This noble vessel, the pride of Bristol and the queen of the ocean, was brought up the river on Saturday morning, 1st ult, and is now in Cumberland Basin, preparatory to her being placed in dock and undergoing various alterations, and for general examination and repair. During this week the public have had the privilege of viewing the interior of this splendid steam-ship on the payment of sixpence for each person, the receipts to be equally divided between the General Hospital and the Infirmary. We understand that nearly 2000!! persons paid to inspect the vessel on Monday, and many hundreds on each following day. This is the first time she has entered the dock gates since she left for London, to receive her splendid and powerful engines; her paddle wheels have been removed to enable her to enter the gates. Her approach to the basin at seven o'clock last Saturday morning was announced by the discharge of cannon, &c. The reception she met with upon arriving (at the dock gates) was very enthusiastic, arising from the loud and deafening shouts which emanated from the persons assembled "to do honour to her appearance." It is intended for her to resume the station she has so ably and successfully filled, on Saturday, the 15th of February, 1840, which will be the commencement of her twelfth voyage across the broad Atlantic.—*Railway Magazine.*

RAMBLES BY PHILOMUSÆUS.—No. IV.

LANDSCAPES ABROAD.

WHATEVER advantage foreign nations may derive by the education of the eye to beauty from the contemplation of objects of art, it is pretty certain that they will not easily surpass us in the scenes of nature. They may possess the same or finer outlines, they may bear the palm for correct drawing, but it is to us they must concede the chiar'oscuro, and what disputes with drawing itself the magic touch of colour. To carry out our artistical allegory, foreign landscape is of an Eginetan cast, severe and correct in its form, but destitute of that animation and finish which mark the later and more cultivated school. It is perhaps from the contemplation of our highly finished scenes, that our painters succeed in colour, and show such proficiency in landscape and cattle; that our poets excel in the descriptive; and that whatever is rural with us, is beautiful without coarseness or rusticity.

An Englishman passes from the tertiary scenes of our beautiful south, to the assimilated district in the neighbouring country of France, he can recognize the same smooth slopes, the same gently swelling knolls, the same richness of soil, and the same softness of character, but he finds a tameness, a want of animation and relief both in broad features and in details, which tell him at once that he is in another and a foreign country. He glides down the beautiful Seine and from St. Germain to below Rouen he perpetually finds a country spoiled from want of care, and a district of great capability wearing the face of a comparative desert. None of the bright fields of his native land, none of its varied and picturesque timber, no beautiful cattle spreading over the distant scene, he misses the hedge and the hedge-row, and above all he misses the dispersed population, the pretty seat or the lowly cot. Instead of these he finds no houses but in villages, little meadows and no variety of timber. From St. Germain to near Havre, there is nothing hardly to be seen but poplar, alder and willow, miles in length of distant forest, or long lines of well drilled poplars spreading along the roads or the divisions of estates. Now the maypole-like poplar is just the very last tree to be paraded thus in single file. The scenery has all the uniformity of foliage of American landscape, and there is only beauty enough to cause the traveller to regret that the whole does not show to equal advantage. On approaching Elbeuf, however, the scene changes, green meadows make up the foreground, the mottled cattle swarm among the pastures, oak and other dark trees, firs and the coniferous tribes, throw shade into the landscape, and the traveller as he looks at the tree-clad hills and grassy slopes is glad to find himself in a land of beauty.

In Flanders we find the same—long ranges of deformed limes and horse chesnuts making the straight roads more horrid, the brooks fringed with pollard willows, poplars like Cleopatra's needles running in lank rows as divisions of property, Scotch firs in patches to fertilize the land, and without meadows, water or cattle, one scene of stiffness and formality. The unhappy trees too are topped off into mopsticks so as to render horror more horrid.

The Dutch, however, if they have a poor country have a rich green sward, the weeping willow, and fine cattle; and an Englishman if he finds little to relieve, find no nakedness to distress the eye.

COMPARATIVE EFFECTS OF THE CORNISH AND LANCASHIRE SYSTEM OF WORKING STEAM ENGINES.

SIR,—As it is not now disputed by any one, that the Cornish or high-pressure expansive system of working the Boulton and Watt engine is more economical than that usually followed in the manufacturing districts, it may probably be interesting to a portion of your readers to have offered to their notice, an easy method of stating or comparing the duty or effects obtained by the two systems, for the purpose of shewing hereafter, the *amount* of saving that may really be expected by the adoption of the Cornish system; and also to have that saving expressed in terms that are generally understood and admitted by practical men.

The following cases are selected, because they have been recently laid before me for the purpose stated, by parties who are interested in having a careful examination of the subject, and who have also furnished me with the facts.

The engine from which the data for the Cornish system are taken, is that lately erected for the East London Water Works Company. The cylinder is 80 inches in diameter, stroke 10 feet, speed 10 strokes a minute, and doing a *duty* of 72 millions of pounds raised one foot high for one bushel, or 94 pounds of coal, the steam being cut off at two-fifths of the stroke. The area of the cylinder, of course, is $80 \times 80 = 6{,}400$ circular inches. The load on the piston is obtained by taking the counterweight which is 29 tons, or 64,960 pounds, and adding thereto half a pound per circular inch, or 3,200 pounds for the friction of the engine itself, making 68,160 pounds for the total gross load; which gives 10·65 pounds per circular inch, for the average pressure of the steam in the cylinder. The velocity of the piston being $10 \times 10 = 100$ feet a minute; the pounds raised one foot high per minute, will be $68{,}160 \times 100 = 6{,}816{,}000$, and the gross horse power exerted, is this number divided by 33,000, or 206·54 horses power.

The Lancashire system is illustrated by a pair of double acting sister engines working in a cotton factory in this country, and attached to the same crank shaft. Each engine has a cylinder of 40 inches diameter and 4 feet stroke, and makes 25 turns in a minute. The gross consumption of coal at the factory is 46 tons a week, the engine running 69 hours in that time. That portion of this consumption used for other purposes than working the engine, is usually estimated at 30 per cent., which includes that for steaming the factory, getting up the steam every morning, waste during meal times, &c. (particulars of which are given in the new edition of my work on steam boilers,) leaving about 32 tons or 71,680 pounds for the net consumption of the engines alone. The area of each cylinder is $40 \times 40 = 1600$ circular inches, the average pressure of the steam in the cylinder as taken by the indicator is 10 pounds per circular inch, and the whole load on the piston is $1600 \times 10 = 16{,}000$ pounds, which, of course includes the friction of the engine. The velocity of the piston is $4 \times 2 \times 25 = 200$ feet a minute, therefore the pounds raised one foot high per minute, is $1{,}600 \times 200 = 3{,}200{,}000$; and the horse power exerted by each engine 96·96, or a total of 194 nearly.

COMPARATIVE DUTY.

	Lancashire.	Cornish.
a, Pounds raised one foot high per minute	6,400,000	6,816,000
b, Gross horse power exerted . .	194	206·5
c, Consumption of coal per week of 69 hours, in pounds . $= d + 69$	71,680	36,804·6
d, $= c \div 69$, ditto per hour $= e + 60$	1038·8	533·4
e, $= d \div 60$, ditto per min. $= a \div f$	17·31	8·89
f, $= a \div e$, Pounds raised one foot for each pound of coals $= g \div 94$	369,728	765,957
$g = f + 94$ Pounds raised one foot high for 94 of coals . .	34,754,432	72,000,000
$d \div b$, Pounds of coal consumed per hour, for each horse power .	5·35	2·58

The letters in the above table indicate the mode of calculation, and it will be perceived that the results in the second column (except the two first lines and the two last,) are obtained by reckoning from the bottom of the column upwards. It must be borne in mind that the horse power exerted by the factory engines as stated above, includes that required to turn the whole of the shafting, about one-third of the whole, which reduces the *net* effective power expended in turning the machinery to $(194 - \frac{194}{3}) = 129\frac{1}{2}$ horses nearly, or 64¾ horse power for each engine, and making the consumption of coal equal to half as much more as before, or $(5{\cdot}35 + \frac{5{\cdot}35}{2}) = 8{\cdot}02$ pounds per horse per hour. What the net effective power of the Cornish engine is, of course, cannot be ascertained without measuring the water delivered, but it is not at all necessary for the purpose of this comparison.

Should the above be considered a fair method of stating the subject, and it is respectfully submitted to the correction of the advocates of either system, I shall be glad, with your permission, to go into the question of the *causes* concerned in producing the great difference observable in favour of the Cornish system, and also the comparative cost or expenditure of fixed capital for the two kinds of engines when doing an equal quantity of work, with a view to test the propriety of adopting the Cornish system in cotton factories.

I am, sir, yours, &c.

R. ARMSTRONG.

Manchester, Dec. 1839.

CURTIS'S PATENT RAILWAY IMPROVEMENTS.

RAILWAY TRUCK.

Fig. 1.—Side elevation.

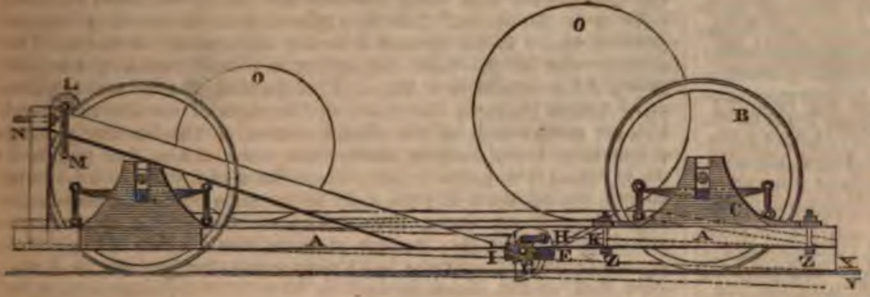


Fig 2.—End elevation.

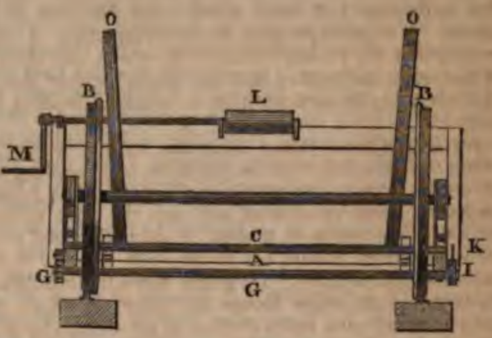
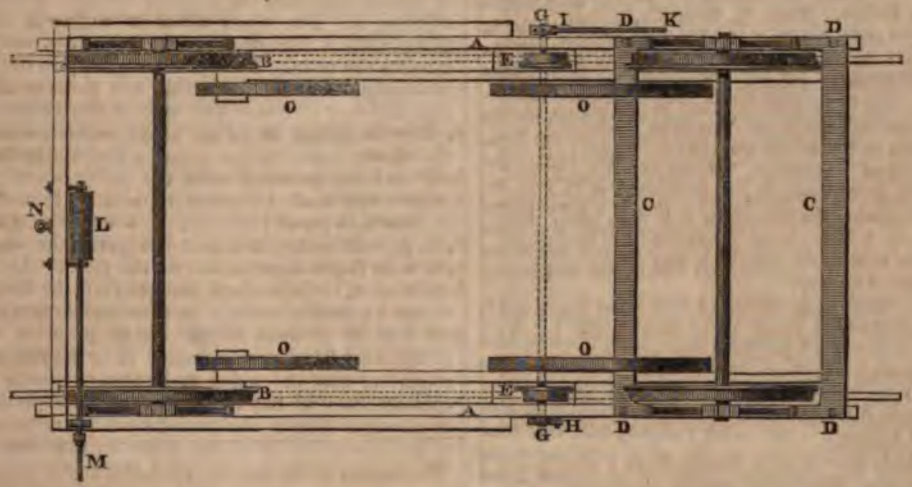


Fig. 3.—Plan.



DESCRIPTION.

Figure 1 is a side view, figure 2 an end view, and figure 3 a plan of the machine, the same letters refer to the same parts of the machine in each figure, so far as the parts are shown in each. A is the framing of the machine, which is suspended below the axle in the usual way, B the hind wheels connected with the shifting frame C, which frame is held in its place by the bolts DDDD, or by any other usual and suitable means. EE are two eccentrics hung upon the cross shaft F, upon one end of which shaft the ratchet G is hung, and upon the other the head I, into the holes of which the lever K is inserted, when it is required to turn the shaft F round, so as to bring the eccentrics into contact with the rails or otherwise. L is a windlass placed upon the front bar of the machine round which a rope coils, so that when a carriage is required to be placed upon the machine, one end of the rope is made fast the carriage, and the other end to the windlass, then a man turning the windlass round by means of the handle M, the carriage is drawn upon the machine; the machine is connected to the train by means of the coupling N in the usual way, and the diagonal bars are placed as shown, in order that the concussion of the train may be transferred to the main frame of the machine A. OOOO are the wheels of a carriage placed upon the machine, the body and carriage is omitted in the drawing, as it is not material to the explanation of the invention that they should be shown.

The mode of operation is as follows:—when a carriage is required to be placed upon the machine, the eccentrics are brought upon the the rails and made to occupy the position shown by the red lines in figure 1, the effect of which is to raise the end of the carriage to which the shifting frame and wheels are attached, a space equal to that included between the shaded line X and the red line Y, and to support it whilst the frame C and wheels B are withdrawn, then the eccentrics are turned back until they occupy the position shown in the drawing, when the end of the machine is lowered to the ground and occupies the position shown by the blue lines ZZ. The carriage is then brought to the machine, the rope from the windlass is made fast to it, the floor of the machine being formed into an inclined plane, the carriage is dragged upon the machine by the windlass with great facility, when placed upon the machine the eccentrics are again brought into the positions shown by the red lines, which raises the end of the machine, the shifting frame C and wheels B are connected with the machine, and made fast by the bolts D, the eccentrics are then brought into the position shown in the drawing, riding clear of the rails; the ratchet G and paul H are provided to retain the eccentrics in any position they may be placed in, the best way to effect all these operations is to place the machine upon a turn table, the fore wheels and the eccentrics being upon the table when the machine can be disengaged from the wheels and placed to receive the carriage in a very simple and easy manner, the same operations apply if the machine is employed for goods or cattle, or any other purpose.

REMARKS ON RAILWAYS,

WITH REFERENCE TO THE POWER, &c. EMPLOYED UPON THEM.

SIR—This subject has occupied my attention for some time past, but I have been more particularly led to address you by seeing the description of Mr. Curtis's endless rope apparatus in the last number of the Journal.

It has often been a subject of surprize to me, that so few attempts have been made to limit the enormous outlay of money in forming modern railways. When almost every branch of mechanics, manufactures and the arts are receiving the attention of scientific men, and when patentees without number are enabling us to do that for sixpence which used to cost us a shilling, ought we to be satisfied with expending all our ingenuity in examining the relative merits of brass and copper tubes, or in ascertaining the best form for rails and chairs, I think not; and though Messrs. Stephenson, who are unquestionably the first railway engineers, may tell us, that without locomotive engines, railways would be nothing, and though by this craft they have their wealth, yet nothing daunted, I will give you my ideas on the subject. We will suppose, for example sake, a railway is to be constructed from one town to another, say from Sheffield to Manchester, where the country is so hilly as to require a summit of upwards of 900 feet, and a tunnel 3 miles long, where the inequalities of the ground are such as to require embankments and cuttings in some places of 90 or 100 feet, and in many of 40 or 50, in order to make it at all suitable for locomotive engines to travel upon. We all of us know, that under ordinary circumstances, 50 feet per mile require the engines to be nearly three times as powerful as those which would be required upon a level, consequently, three times the weight of coke and fuel, as well as a great addition to the weight of the engine and tender, therefore, it becomes a question of some importance to ascertain whether a cheaper power cannot be adopted than locomotive engines. About ten years ago, Messrs. Walker and Rastric gave it as their opinion, that Mr. Thompson's plan of reciprocating ropes would be found more economical for the Liverpool and Manchester railway than locomotive engines. And be it remembered, this railway is uncommonly favourable for locomotives, compared with nearly all the others in England, with the exception of the two inclines. The only advantage gained by locomotive engines over the stationary system, since their report, is economy in the consumption of fuel, by having tubes instead of a large flue, and though this is a very great improvement, how is it that with a consumption of fuel not one-fourth of what was anticipated, we are told they cannot afford to take goods so as to leave a reasonable profit. The only solution to this problem is, that the expense incurred in levelling and forming railways, so as to make them fit for locomotive engines, together with the original cost, wear, and tear of locomotive engines, tenders, and rails, is such as to demand a larger toll upon the goods than can be afforded. Not to weary your readers by going into calculations, I will assert that the plan of endless ropes will be found in the case of the Sheffield and Manchester railway, or any other railway, with one continued rise to the summit of 35 feet rise to the mile, to be far more economical and efficient than locomotive engines. If we reject locomotive engines, the face of the country will not want excavating or embanking, excepting in a very few cases, which will save probably one-half of the original outlay, viz. £400,000., and the interest of this at 5 per cent., which is £20,000. per annum, will be saved to the shareholders; other things being the same, and that other things are as favourable must be our next business to prove. Any person acquainted with the country in question, will admit that reservoirs may be formed and water collected to almost any quantity, (of course without injury to the mill owners,) at or near the level of the summit, for a trifling expense, which will furnish us with sufficient power without having recourse to locomotive engines. We will pass over the intermediate steps of engine-houses, water-wheels, &c. from an anxiety to keep these remarks within reasonable limits, and not from an inability to go into them. The principal objections to the reciprocating plan, or any other plan with ropes I have seen, are that the trains must all arrive together, stop at the stations to be hooked on and off, and in some of them cross over to the other rails. We will not dwell upon these objections, but provide the remedy, which is to divide the line into lengths of one mile each, and to have a station at the end of each mile, these will be divided into two kinds, the first contain the engine, water-wheel, or whatever the power may be, and are placed every other mile; we will call them No. 1, 2, &c. The second stations are, where the two drums, or large pulley wheels are placed, and occur every other mile, being placed halfway between the first mentioned, we will call these A, B, &c. From one of these stations to the other, extends an endless rope of two miles long, or one mile from wheel to wheel; one end passing round one of the wheels at the numerical stations, and the other round one of the wheels at the alphabetical, there being two wheels at each station, capable of working in concert, by means of which two endless ropes can be worked by one engine in both directions. It is not intended to work more than one at once by one engine, but only to give a signal to the man at the station No. 2, that he must set the engine or water-wheel going, and at the same time it is intended to couple them so as to ensure a uniformity of speed between the two ropes, before the train changes from one to the other, therefore one engine will be working at each end for a short time, there being two endless ropes coupled together working between them. This system of signals to be observed throughout the line; the object of it is to prevent any jerking or breaking of ropes, &c., as there are no stoppages at the stations, the first endless rope being liberated and the second taken when the train is at full speed. The way this is done is by a long iron bar fixed obliquely in the gronnd near the rope, nearly in the same direction, and as the first carriage passes over this bar, one side of the claws or holders of the rope, slides along the bar and is forced open, which liberates the rope; the impetus of the train carries it forward to the rope at the second station, (twenty or thirty yards would be sufficient,) where another bar fixed in a manner similar to the bar already described, again opens the claws, and a fork likewise fixed in the ground under the rope by the same operation, throws the rope between the claws, they close upon the rope and the train proceeds. The relative distance of claws, bars and rails being always the same, this part of the machinery can never get out of order, nor require any superintendance.

To elucidate the system proposed still farther, we will suppose a train is about to leave one end, when none of the ropes are in motion, it is first brought along the railway a little in advance of the station No. 1, then a pair of claws fixed on the first carriage, (which open by a lever and close by a strong spring,) grasp the rope, but without injuring it. The water-wheel or engine is then put in motion, and along with it the drum or pulley-wheel, endless rope, and consequently the train. The speed is got up to the maximum, and thus it proceeds till it arrives within 200 yards of the station A, being the first half-way station. The man at this station by a conical coupling, spring coupling, or in any other manner, which will gradually effect the same, connects the pulley-wheel of the first endless rope, or the one already described with the pulley-wheel of the second endless rope. The second endless rope is set in motion, and by this signal, viz. the moving of the rope, the man at the station No. 2, puts on the power, and before the train has got to the second rope, the speed of the rope is the same as that of the train. As soon as the man at the station No. 1 judges the train has left the first rope, he takes off the water or steam, and the first endless rope leaves off running. It is not needful to describe the trains' progress forward, for the same thing occurs at every change. It is evident from the foregoing description, that the going train always keeps to one side, and the coming train to the other, and as the rope is the propelling power, or means of power, one carriage can never overtake another. A carriage to be taken up at any place on the line, may either be done in the manner described by your correspondent, or by an incline, to set the carriage in motion long enough to get up its speed before it is fixed to the train. In conclusion, I will make a few general remarks; upon considering the subject, two important facts force themselves into view;—the first, that almost any number of undulations may occur in the line of the railway, provided there be no convex curves in the section of the ground in the space of one mile, (concave curves would not signify, for they would diminish the friction of the rope rather than add to it.) The second is, let the country be as mountainous as the Simplon, railways may with advantage be made over it, provided there be a considerable traffic. The first of these will enable us to make railways at one-half the cost of the present system, the other to choose our own ground, and not be obliged to go in a particular direction or level, to suit locomotive engines, leaving large towns entirely out of view.

Here we can have a railway at one-half the expense of the other, at one-half the wear of rails, have no collisions between trains, and at no greater annual expense, but we won't have it;—and why? because if such a thing were attempted, Demetrius and the craftsmen, (and they are a very powerful body,) would run about the share-market and shout with a loud voice, "great is Diana of the Ephesians," and all the directors and shareholders in the railways already made, would stifle all argument with the cry of "great is Diana of the Ephesians," and at last, like poor silly sheep going to the slaughter, the projectors of and subscribers to contemplated railways, would join in the cry, and louder and fiercer than any shout "great is Diana of the Ephesians—great is Diana of the Ephesians."

Sheffield. DIOGENES.

(To be continued.)

PROFESSIONS IN FRANCE.

"THEY do these things better in France," has been echoed by Sterne's Starlings almost for the last century, and that we may enable our readers to pick out what good they can, and eschew the evil, we have thrown together some notes, based upon official documents and upon the almanacks and directories. With regard to the directory, by the bye, it comes from the hand of an editor with many tails, and is dated in the 32d year of the publication, and in the 10th year of our reign, or as it phrased X^e *de la continuation par l'Editeur actuel* (*Editeur*, usually means publisher.) ,

We shall throw our notes together just as they come, and leave their connexion to the industry of our readers. One of the first things that strikes us, is a dealer in essence of mahogany (*essence d'acajou,*) though what that is, we do not know. The list of country architects is, to a great degree, filled up with surveyors, as they are there called *geometres du cadastre.* Among the cement dealers we find Impermeable Mastic Powder of the Romans, Stone-coloured Mastic, Adialyte Roman Cement, Lucidonic Colour, Economic Bituminous Painting, (we presume tarring fences,) Hydrofugic Mortar, Hydrophyluctic Mortar, &c. One brick-maker has an establishment for making moveable terra cotta letters for shop boards; the master carpenters are formed into a body by a police ordonnance of the 9th December, 1808, for internal government, for inspecting the solidity of buildings, and for preventing pieces of carpentry from being placed so as to cause fires. Their tools must be stamped with a punch bearing their family name at full length; no journeyman must work on his own account beyond two days, without a previous declaration at the Prefectore of Police. Oh, blessed state of affairs! when shall we have the advantage of protection from the authorities of Scotland-yard, and be under the enlightened directors of the nearest station-house. The masons and locksmiths enjoy the same privileges; the paviors also, by a police ordonnance, are prohibited from undertaking any work without being inscribed at the Prefectore, and having their tools stamped with their names.

The number of well borers is ten; designers of bronzes, carpets and ornaments, ten; designers of paper hanging, twenty. There are several offices for doing specifications, drawings, measurements, estimates, &c. The gas fitters are twelve. Of engravers, there are in mezzotinto nearly a hundred; architectural, twenty; topographical, thirty; in wood, twenty; for paper hangings, ten; of lithographers, fifty. The engineers are all government functionaries, dispersed over the provinces, except about thirty civil and practical engineers at Paris. The steam-engine makers are six-and-twenty; the modellers, eleven; moulders of effigies, fifteen; mosaic factories, five; scene painters, seventeen; decorative painters, fifteen; painters of artificial marbles and woods, thirty; glass and enamel painters and gilders, thirteen; platina manufacturers, twelve. The surveyors are about two hundred and fifty in number.

The next portion of our subject, will be the immense mass of government functionaries, one of the best tests of professional independence, whatever it may be of national encouragement. The first that comes in our way is the royal household, direction of crown buildings, with thirty-three architects of all grades. The next is the private domain of the king, with another board of architects. We then have the home department, directors of public buildings and monuments, with twenty-one employers of the general board, and a hundred and five district functionaries employed in different public works. The Prefecture of the Seine, almost equally prolific, has about a hundred and fifty. The Prefecture of Police has also a number of good births—the division of architecture alone, sixteen.

The engineers come off as well. In the war department, they are, of course, well provided for; but the ministry of public works, is their great support, there are to be found the names of fifty. In the Prefecture of the Seine, about as many.

COMPETITION DESIGNS.

SIR—You will perhaps favour me by inserting the following in an early number of your useful Journal.

Derby, Your's respectfully,
13th Dec., 1839. B.

Two advertisements for designs have appeared in the "Times" this month, one for laying out 25 acres of ground near Ipswich, for which premiums of 30*l*., 20*l*., and 10*l*. were liberally (?) offered; the designs to be sent in by the 30th of this month! The other design required was for the Lincoln Diocesan School, to accommodate 200 boys; with a master's house attached, to have accommodation for 40 boarders, which was to be furnished by the 17th of this month (!) the board to assemble on the 18th, to make their selection (!!!) A short time since, designs were requested for a gaol at Peterborough, which were to be sent in by *twelve o'clock* of the 30th November, *when* the magistrates would meet to select the design! These last two cases, if the designs were really selected at the time announced, form a beautiful contrast to the dilatoriness of which Mr. Dionysius complains in the Sunderland Athenæum committee. The gentleman, Mr. Billington, whose design is adopted by that body, is an architect, surveyor, and civil engineer, as well as joiner and builder, in Wakefield.

It may be satisfactory to the "young architect" to know that tenders for the works were advertised for certainly three months since, as he may ascertain by reference to the "Leeds Mercury" of about that date.

The exertions of the Manchester Architectural Society are entitled to great praise from the profession. It is their intention, with the concurrence of the competing architects, to exhibit the designs for the Lancashire Independent College, which were advertised to be sent in by the 19th of October last. The building to cost £12,000.

Of the favourable result of such exhibitions, I am very sanguine—as they will awaken an interest in, and a taste for architecture among people in general; besides acting as a check upon the judges in competition.

But what are the Institute and the London Society doing? It is now three years since the first part of the first volume of the "Transactions of the Institute" appeared. Are we to have no more? The non-appearance of part the second does not speak *volumes* in favour of the interest of the communications that the Institute has received; unless, indeed, the publication of the Transactions was a failure. As to the Society, as far as we provincials are concerned, it is perfectly barren. Why do not *they* follow the example of the Institute, and throw open *their* competitions to the profession at large?

I consider that the Institute might exert itself very beneficially on behalf of the profession, by interfering in competitions.

I suggest that a sub-committee be appointed, which might be called the Competition Committee, whose business it would be, when designs are advertised for, to direct the Secretary to obtain particulars; and should they consider the time allowed too brief, or the premium too small, to urge upon the parties advertising the desirableness of increasing either. By thus bringing the matter home to the different bodies, I apprehend that the profession would be generally thought more respectable. The exertions of such a body, would be more likely to succeed than the isolated efforts of individuals.

To parties about to advertise, if requested, the Committee might furnish many useful hints. In addition to this, they might have exhibitions of the designs in remarkable competitions, and thus obtain some increase to the Institutes' income.

If, following the example of the Useful Knowledge Society, they would appoint local committees throughout the country, they would have their trouble lessened, and would unite the profession more intimately than it is, These committees, it is evident, may collect much useful information; as every provincial architect is not *personally* acquainted with these metropolitans, It should not, I think, be considered essential that the local committee be members of the Institute, but provincial architects, of whose professional standing the council was satisfied, might be requested to act. Though these suggestions may not meet with approbation, I must regret that neither the Institute, nor the Society, have opened an exhibition of the Royal Exchange designs. The gods will not help them who will not help themselves, neither will the world assist an apathetic profession.

It is to hoped that the Liverpool Society will exert themselves to obtain an exhibition of the Assize Courts designs; though the non-exhibition of the designs for the St. George's Hall argues a great deal of inactivity or apathy on their part.

That competition seems to have reached a satisfactory conclusion, For, though some may think that a better design might kave been selected, nobody will question the honourable conduct of the "Liverpool gentlemen."

B.

COMPARATIVE POWER OF STEAM ENGINES.

The following calculation by Mr. Wicksteed, the engineer of the East London Water Works, exhibiting the saving of fuel to be effected by using a single acting expansive engine and an overshot water-wheel, instead of a double-acting condensing engine of the ordinary kind will be found interesting. This was made at the request of His Excellency Edhem Bey, ambassador from the court of Egypt, upon his late visit to this country.

A double-acting low-pressure engine of the ordinary construction of 50 horses power for spinning cotton, will consume from 10 to 15 lbs. of coal per horse power per hour, say on an average 12 lb. This is, however, a low estimate for Lancashire, where the consumption is generally much greater, coal being there less expensive than in several other parts of England. If we allow 311 working days per annum of 12 hours each, we shall have the total consumption of the above engine for one year = 50 × 12 × 12 × 311 = 2,239,200 lb. = 999 tons, 12 cwt. 3 qrs. 12 lbs., say 1000 tons at 50s.* = £2500.

A single-acting expansive engine on the Cornish plan of 50 horses power, if used for raising water to turn an overshot water-wheel, will not produce a power of 50 horses available for working the cotton machinery, since the effect of the water, when applied as a motive power, through the medium of the overshot water-wheel, will not exceed 66 per cent. of the power required to raise the water. Now 66 : 100 : : 50 : 76 = the number of horses power of the engine which will produce the same mechanical effect by this plan as by the usual mode.

A Cornish engine of 76 horses power will consume from 2 to 2½ lbs. of coal per horse power per hour, say 2½ lbs.; thus the consumption for one year will be equal to 76 × 2·5 × 12 × 311 = 709,080 lbs. = 316 tons 11 cwt., say 317 tons at 50s. = £792 10s.

COMPARISON.

The cost of coal per annum by the common mode is	£2500	0	0
Ditto by the proposed mode . .	792	10	0
Saving per annum = 68 =	£1707	10	0

The irregularity of the action of the steam in ordinary low-pressure engines is very nearly counteracted by the use of a fly-wheel; nevertheless, in some of the cotton factories, (for instance, that of Messrs. Lane, of Stockport) two engines are employed to work the same machinery, the cranks being fixed at right angles to each other, as in marine engines. Shis arrangement equalizes the action of the steam still more, yet the motion is not so regular as that of an overshot water-wheel, where the supply of water is uniform, as it would be in this case, the speed of the engine being regulated by the use of the cataract, to any given number of strokes per minute, and the delivery of water consequently uniform.

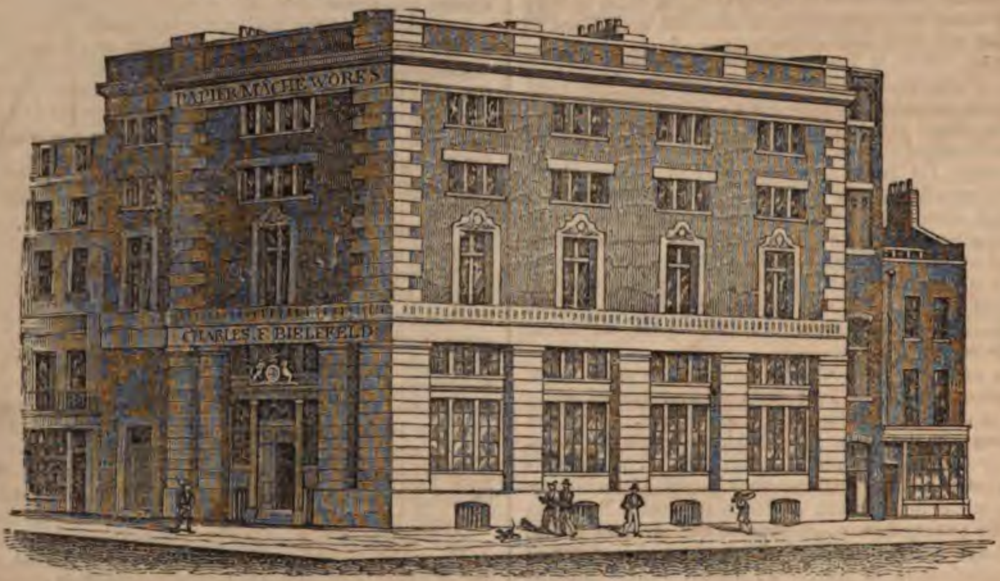
It should be observed that no large quantity of water will be required, as the same water may be used over and over again with very little loss.

When this calculation was made, very little practical knowledge of the consumption of coals for a Cornish engine in London had been obtained, and although we have never disputed the reports from Cornwall, yet many engineers of great experience had doubted the correctness of the accounts from Cornwall; it has now, however, been proved that the great engine lately erected by the East London Water Works Company at Old Ford, does not consume upon an average more than $2\frac{6}{10}$ lbs. of coals per hour per horse power, and as the coals used are the refuse of Newcastle coals, the largest piece not being greater than ¾ inch in diameter, we can have no doubt that Mr. Wicksteed's estimate of 2½ lbs. of coals per hour per horse power of *large* coals may be safely relied upon.

---

† This is the price of coal in Egypt.

BIELEFELD'S PAPIER MACHÉ WORKS.



BIELEFELD'S PAPIER MACHÉ WORKS.

A no less singular than conspicuous object, the building lately erected in Wellington Street, North, can hardly fail to attract notice, yet at the same time is likely to puzzle the architectural critic. It has already been spoken of both in the Companion to the Almanac, and in an article on London Shops and Gin Palaces, in the December Number of Fraser's Magazine; nor do we see reason to dissent greatly from the opinions there expressed. The defects of the design is that there is very little sort of agreement between the upper and the lower portion of the building, either as to style, character or material. While the latter is exceedingly plain and sober, the other is fanciful—not to say freakish in the dressings given to the first floor windows, which, nevertheless, do not possess the degree of richness, which would reconcile the eye to what, it must be acknowledged, is *outré* in manner, and which therefore required to be treated not with coldness, nor even sobriety.

We do not object to an intermixture of stone and red brick; on the contrary, we are of opinion that it might frequently be rendered productive of considerable effect; but then we should like to see the two materials combined throughout, from the ground upwards, and not, as is here the case, have a building look as if begun and carried up to a certain height in stone-work, and then completed in brick with only stone dressings. Again, the piers below look narrow and weak compared with those between the windows of the first floor;—a fault that might have been obviated by arching the openings between them, and making the entresol windows in the heads of the arches. This would also have diminished the formality now occasioned by the numerous horizontal lines of those windows and openings, and unnecessarily increased by those of the horizontal rustic joints.

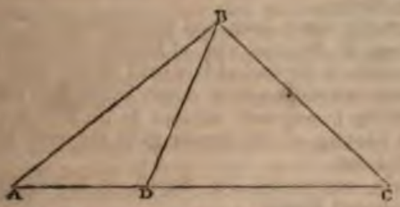
In one respect, indeed, the whole possesses a certain merit, because there is hardly a possibility of mistaking what the building is intended for. Its aspect at once announces it to consist not only of a shop below but a manufactory in the upper stories. It likewise contains spacious show-rooms, relative to which and their contents we shall probably be able ere long to give a more detailed account. The building stands at the corner of Wellington and Exeter Streets, the narrower front or end, being towards the former, the longer one towards the latter; but in regard to this some liberty has been taken in the cut, for though the whole of the South side of the building is shown, not more than the first two windows from the corner of Wellington Street would be visible in the direction here chosen, owing to the narrowness of the other street.

ON THE TESTING OF SURVEYS BY CALCULATING THE LINES OF CONSTRUCTION.

By S. Hughes, C.E.

In transferring to paper the measured lines of a large survey, it is always considered by the surveyor a matter of great satisfaction if the lines prove or fit in to each other as it is called.

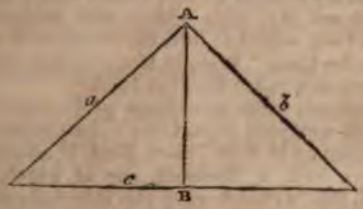
That the meaning of this term may be understood by those who are not conversant with the practice of surveying, suppose three lines have been measured in the form of a triangle, A, B, C, and a fourth line B, D has been measured from one of the angular points to D in the opposite side. It is evident that the three sides of the triangle being given, the length of B D is determined, and ought on the ground to measure neither more nor less than the distance in a direct line from B to D.



Now, if on laying down the above diagram on paper it be found that the distance between B and D either exceeds, or is less than that measured on the ground, the presumption is that an error has been committed, and the work should forthwith be examined in order to discover it. BD is called a proof line, and the above example is given to illustrate the nature of these lines.

The object of this paper is to investigate a few simple formulæ for determining the lengths of proof lines by calculation, in order to save the trouble of laying down at an inconvenient time the main lines of extensive surveys, and to guard against the danger of error in laying down the lines on paper.

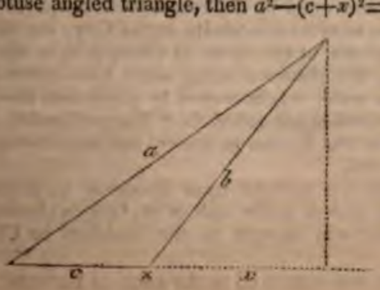
Prob. 1st.—Let a, b, c, be the three given sides of a triangle, it is required to determine the perpendicular A B from the vertex to the opposite side c, and also the segments into which the side is divided



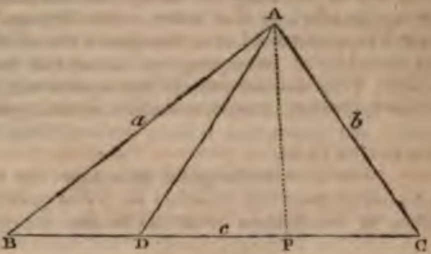
by such perpendicular. Put $x =$ one of the segments, and we have $a^2-x^2=b^2-(c-x)^2$ or $a^2-x^2=b^2-c^2-x^2+2\,c\,x$ add x^2, and $a^2=b^2-c^2+2\,c\,x$; subtract b^2-c^2 and $a^2-b^2+c^2=2\,c\,x$. Divide by $2\,c$ and $\frac{a^2-b^2+c^2}{2\,c}=x$ or $\frac{a^2-b^2}{2\,c}+\frac{c}{2}=x$ the greater segment.

Now the difference of two squares is equal to the product of the sum and difference of their roots. Let s and d be the sum and difference of the two sides a and b, then $\frac{c}{2}-\frac{s\,d}{2\,c}=x$ the greater or less segment, according as the positive or negative sign is used in the formula. The perpendicular A B of course will be $\sqrt{a^2-x^2}$. From the nature of similar triangles it is also $=\frac{x\,a}{b}$ where x is the lesser segment, and $=\frac{x\,b}{a}$ where x is the greater segment.

Suppose an obtuse angled triangle, then $a^2-(c+x)^2=b^2-x^2$ or $a^2-c^2-x^2-2\,c\,x=b^2-x^2$. Add x^2 and $a^2-c^2-2\,c\,x=b^2$. Add $2\,c\,x$ and $a^2-c^2=b^2+2\,c\,x$. Subtract b^2 and divide by $2\,c$, then $\frac{a^2-b^2}{2\,c}-\frac{c}{2}=x$, or substituting as before the sum and difference of a and b we have $\frac{s\,d}{2c}-\frac{c}{2}=x$, and the perpendicular here will be $\sqrt{b^2-x^2}$.

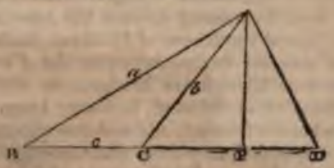


Application I.—Given the three sides $a\ b\ c$ of an acute angled triangle, also B D, and consequently D C the segments of the base c, required the length of the proof line A D.

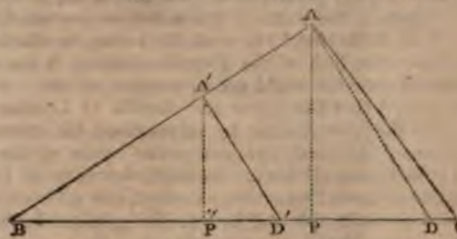


Put B D $=d$ the perpendicular A P as found by the preceding problem $=p$, and, the segment B P also found by the problem $=s$, then $\sqrt{p^2+(s-d)^2}=$ A D.

Case II.—Let the triangle be obtuse as A B C, then retaining the same letters as above $\sqrt{p^2+(d-s)^2}=$ A D.



Case III.—In the triangle A B C, the three sides are given, also the distances B A′, B D′ required the length of the proof line A′D′.

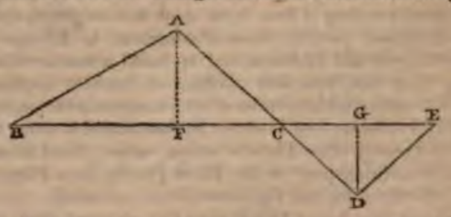


Through the point A draw AD parallel to a A′D′, then BA′ : BA : : BD′ : BD and AD may be found as shewn in case I. Then we have BA : BA′ : : AD : A′D′ the length required.

Or suppose the two sides B A, and BC are given also B A′, B D′ and A′ D′ and the length of the proof line A C be required. Through A′ and A draw A′P′, and AP perpendicular to BC and find the length of A′P′ by the problem. Then B A′ : B A : : A′P′ : AP find also the length BP, and then $\sqrt{\mathrm{AP}^2+(\mathrm{BC}-\mathrm{BP})^2}=\mathrm{AC}$.

Corollary. By means of the formula in this case may be determined also any proof line measured on the opposite side of the base line to that on which the triangle has been constructed.

Thus let A B C be the triangle of which the sides are given, and of



which one of them A C has been continued to D, and its extremity connected by the line D E, with another of the sides B C also produced to E. Draw A F and G D perpendicular to B E, and find the length of A F by the problem, then AC : CD : : AF : DG. The distance CG will then be $=\sqrt{\mathrm{CD}^2-\mathrm{DG}^2}$. And $\mathrm{ED}=\sqrt{\mathrm{GD}^2+(\mathrm{BE}-\mathrm{BG})^2}$

ON THE SUPPLY OF WATER TO THE METROPOLIS.

Observations on the past and present supply of Water to the Metropolis. By THOMAS WICKSTEED, *Civil Engineer. Read before the Society of Arts, May* 24, 1835.

[This paper which we now present our readers was originally published in the Transactions of the Society of Arts; as we consider its merits entitle it to a more extended circulation, we thought that we could not do a better service to its author and the public, than to take this opportunity of calling attention to it.]

I TAKE the liberty of prefacing the observations I am about to make upon the past and present supply of water to the Metropolis, by stating that it was at the repeated request of my valued friend Mr. Aikin that I was induced to think of attempting to amuse the Society for an hour; and, should I be unsuccessful in the endeavour, I trust credit will be given me for trying, at least, to make a return, however trifling, for the pleasure and instruction I have derived from this Society during the last twelve years.

It will be my object to show the great advantages the inhabitants of this Metropolis derive from the abundant supply of good water which they now have, in comparison with the scanty supply in ancient times.

Supply previous to A.D. 1236, *by Running Brooks.*

The inhabitants of London and its suburbs previously to the year 1236, in the reign of Henry III., were supplied with water not only by the Thames, but also by the following streams, namely, the River of Wells, Old-bourne or Hill-bourne, Wall-brook, and Lang-bourne.

The River of Wells, so called from its being formed by the united streams from several wells in the neighbourhood of the Charter House and Smithfield, flowed to Holborn Bridge. The Old-bourne, or Hill-bourne, so called from its running down a hill ,rose near Holborn Bars, and running west, joined the River of Wells at Holborn Bridge; from thence the united streams flowed between the Fleet and Bridewell into the Thames near Blackfriars Bridge. In 1307, at a Parliament held at Carlisle the 35th of Edward I., Henry Lacy, Earl of Lincoln, complained that whereas formerly the watercourse under the Fleet and Holborn Bridges was sufficiently deep and wide to allow ten or twelve ships at once, loaded with merchandize, to come up to Holborn Bridge, but that in 1199, in the first year of his reign, King John had granted to the Knights Templars ground to erect a mill upon, at Castle Baynard, and the whole of the water in this watercourse (which was afterwards called Turn Mill Brook) to work it; owing to which diversion chiefly, and also to the filth of the Tanners choking it up, and divers other impediments, vessels could not now enter as they were wont; he therefore prayed that the mayor and sheriffs of London might be directed to view the watercourse to substantiate his statements. It was in consequence cleansed, but was never again of the depth or breadth that it had formerly been. In 1502, the 17th of Henry VII., the whole course of Fleet Dyke, then so called, was effectually cleansed so as to allow boats with fish and fuel to navigate as far as Holborn Bridge.

In 1589, in the 31st of Elizabeth's reign, the Common Council of the city granted a fifteenth for the cleansing of this brook, or dyke, and for this purpose the springs on Hampstead Heath were collected into one head and conveyed by means of a channel to Fleet Ditch, to scour it out: but after spending a large sum of money, the work proved a failure, and the banks falling in, the Ditch was choked up more than ever.

In 1668, in Charles the Second's reign, after the fire of London, it was again cleansed, and a handsome canal was made with brick walls and wharfs on each side as far as Holborn Bridge, 2100 feet long, 40 feet wide, and 5 feet deep at a middling tide; but the expense of making this canal, wharfs, &c., (amounting to nearly £28,000,) and the annual cost of keeping it free from mud was so great, that in 1733 the citizens obtained powers from Parliament to fill up the ditch between Fleet Street and Holborn, and to build a market thereon, the act providing that two spacious arches, of 10 feet high and 6 feet wide, should be made and maintained as common sewers, to carry off the waters of the rivulets and sewers that used to fall into the ditch; and in 1760, in George the Third's reign, when Blackfriars Bridge was built, the remaining part of the Fleet Ditch, from Fleet Street to the Thames, was filled in, and the sewer was extended.

It would appear that Fleet Ditch was the channel into which the River of Wells, from the east, and the Old (or Hill) Bourne from the west, flowed, and that the tide flowing up to Holborn Bridge made it navigable so far. That at one time it was called the River of Wells because that was the largest rivulet that ran into it; afterwards Turn Mill Brook, when it was rendered unnavigable by the erection of the Knights Templars' Mill, and the consequent diversion of its waters; afterwards, when the mills were removed, and it was cleansed again and rendered navigable, Fleet Dyke, so called because it was a watercourse allowing many vessels or a *fleet* to pass up;—and afterwards Fleet Ditch, when the unsuccessful attempt to scour it, by means of a channel (which channel is now also called Fleet Ditch,) from the Hampstead springs, had been made. The Old (or Hill) Bourne is now covered over.

Wall-brook derived its name from the circumstance of its being the only running brook that passed through the City walls.

It entered the City near to the east end of Beth'em Hospital, between Bishopsgate and Moorgate, passed on to Lothbury, under St. Mildred's church, Bucklersbury, Wallbrook Street, and Dowgate Hill into the Thames. It is said to have been in ancient times navigable as far as Bucklersbury. It is now arched over, and houses are built over it in many places.

Langbourne-water was a long and great stream of water breaking out of the ground at the east end of Fenchurch Street, and running directly west, nearly to the end of Lombard Street, turned to the south and divided into several rivulets, some falling into the Wall-brook, and others running in separate streams to the Thames at Dowgate; the division, or *sharing*, of the stream gave the name to Sharebourne (or Sherbourne) Lane.

A watercourse intersected the Strand at Salisbury Street, and another near Somerset House.

Supply previous to A.D. 1236 *by Springs.*

Besides these running streams there were a great many wells and pools, namely, Holywell, in Shoreditch; Clement's Well, in St. Clement's Inn in the Strand; Clerks' Well, near Clerkenwell Church, so called from the parish clerks of the City of London, who used formerly to meet there for the purpose of representing certain parts of the Scriptures in a theatrical manner. "These wells," says Fitz Stephen, who was in the service of the famous Thomas à Becket, and wrote a life of that celebrated prelate, "may be esteemed the principal, as being much the best frequented, both by scholars from the schools, and the youth of the City, when in a summer's evening they were disposed to take an airing." Near to Clerks' Well was Skinners' Well, where plays were in ancient times performed.

More eastward, towards the Charter House, were Fagges-well, Todswell, Loders-well and Red-well, which, with another in Smithfield, called the Horse Pool, united to form the River of Wells.

"Dame-Annis-the-Clear" Well, in Hoxton; and, somewhat west of this, Perilous Pool, now called Peerless Pool.

Without Cripplegate there was a large pool supplied by Crowder's Well, on the north-west side of St. Giles's churchyard.

There was a fountain in New Palace Yard, Westminster.

There were two wells in Shadwell, one of which, a fine and clear spring near to St. Paul's church, gave this suburb its name.

Besides those herein enumerated there were many smaller ones, the situation of which may still be discovered by the names of the streets and alleys or places in their neighbourhood, such as Monks' Well, Bride Well, formerly called Bridget's Well, &c.

London supplied by Conduits subsequently to 1236.

Stow says, "The said River of Wells, the running water of Wallbrook, the bournes afore named, and others the fresh waters that were in and about this City, being in process of time, by encroachment for buildings and otherwise, utterly decayed, and the number of citizens mightily increased, they were forced to seek sweet waters abroad, whereof some" *springs*, "at the request of King Henry the Third in the 21st year of his reign, were, for the profit of the City and good of the whole Realme thither repairing, granted to the citizens and their successors by one Gilbert de Sanford, with liberty to convey water from the towne of Teiborne by pipes of lead into their City." The Tybourne rivulet ran though Tothill Fields to Scholars' Pond, and thence into the Thames; it is now a common sewer. The grant was made in 1236; the work was commenced in 1285: the waters from Tybourne were conveyed by a six-inch leaden pipe to Charing Cross, and from thence to several conduits in the City, the first and greatest of which was erected at the Cross in Cheapside, at the end of Wood Street, in 1285, the distance being about three miles and a half, and for the *first time* water was conveyed by pipes into the City.

In 1401 the prison-house called the "Tun on Cornhill, was converted into a cistern for the Tybourne water, and was afterwards called the Conduit on Cornhill.

In 1423 water was brought from Tybourne to Billingsgate, Paul's Wharf, and to a cistern in the wall of St. Giles's church, Cripplegate.

In 1430 water was brought to the Standard in Cheapside, near Honey Lane.

In 1432 water was conveyed to the gaols of Newgate and Ludgate.

In 1438 water was brought from Tybourne to conduits in Fleet Street and Aldermanbury, and from Highbury to a conduit opposite Cripplegate church.

In 1439 the Abbot of Westminster granted the City one head of water, containing about 800 square yards, or the sixth of an acre, together with all its springs in the manor of Paddington, *provided* the intended work did not *draw* the water from the ancient wells in the manor of Hida; showing by this proviso that four hundred years back it was discovered that any great draught from one well would be likely to leave the other neighbouring wells dry. This grant was confirmed by Henry the Sixth in 1441; and other advantages were granted by a writ of Privy Council, to enable the citizens to bring water by means of leaden pipes under the ground for "above three miles" to a conduit in Cheapside, which was erected in place of the old one at the Cross, which Cross was also re-edified at the same time; and this conduit was used as a reservoir for the supply of other conduits. The water was conveyed from the springs to cisterns at Tybourne, from thence to Charing Cross, and thence to the City.

In 1443 a new conduit was erected near St. Paul's Gate, at the upper end of Cheapside.

In the Old Bailey, a little lower than the Sessions House, was a large cistern with divers cocks, which received the waste water from the prison of Ludgate, for the use of the neighbouring inhabitants.

In 1471 a fresh supply of water was brought by leaden pipes from Tybourne to a conduit erected in Fleet Street, at the end of Shoe Lane, and to other conduits, for the benefit of the people; viz. "for the poor to drink, the rich to dress their meat."

In 1478 a cistern was added to this conduit to hold the waste water, and another at Fleet Bridge.

In 1491 a conduit was erected in Grasse (or Gracechurch) Street.

In 1498 a conduit was erected at Oldbourne Cross, and was again new made in 1577 by William Lamb, citizen, who having drawn together several springs of water into a head at the upper end of Red Lion Street, which was called Lamb's Conduit, conveyed the same to a conduit on Snow Hill, by a leaden pipe 2000 yards long.

In 1509 a stone conduit was erected in the Stocks Market which stood at the north corner of Wallbrook.

About the year 1513 a conduit was erected in Bishopsgate Street.

About the year 1528 a conduit was erected at London Wall.

In 1535 water was brought from Hackney to a conduit erected in Aldgate.

In 1543, notwithstanding the vast expense the citizens had been at in bringing water to, and erecting conduits in, the City, the supply was very inefficient; and an Act was passed in the 31st of Henry VIII. empowering them to bring water from Hampstead Heath, St. Mary le Bon Hackney, and Muswell Hill, upon their compensating the owners of land for damage done by digging or otherwise.

In 1546 water was conveyed in great abundance from divers springs lying between Hoxton and Islington to a handsome conduit erected at the west end of St. Margaret's church, Lothbury.

The Charter House was supplied from White Conduit Fields; Christ's Hospital, from the Devil's Conduit, north-east of Brunswick Square.

Stow mentions amongst the remarkables in the City of London a well at Aldgate curbed with stone of a great depth, and rising into a house two stories from the ground, which is peculiar, "for I have not seen the like in all this City to be raised so high."

There were other conduits of less note than those now enumerated, and wells with buckets or pumps in Threadneedle Street, Leadenhall Street, &c.

Sir John Evelyn writes that about the accession of Queen Elizabeth, in 1558, the waters of Dame-Annis-the-Clear Spring at Hoxton were carted to the breweries in London, at an expense of 800*l*. per annum; and about the same time wells were dug and pumps erected in every corner of the City and suburbs.

Water raised from the Thames by Machinery.

In 1568 a conduit was erected near the top of Dowgate Hill, which was supplied with Thames water by means of a ginn, or machine for raising water, fixed near the river,—most probably what is termed a horse-wheel.

This appears to have been the first machine used in London for raising water for the supply of the public to a higher level than could be done by the common pump.

Thus it appears that London was supplied, first, by running brooks and springs, and secondly, when these failed, by water brought from a distance through leaden pipes, the sources being at a sufficient elevation to allow the water to run into the conduits. In a few instances the waste water from these conduits ran into cisterns adjacent to them, for common or public use; but water was of too much value at that time to allow this to be done generally, and in cases of fire the supply was miserably deficient, which, together with the circumstance of timber being the common material used in the buildings, accounts for the number of destructive fires in ancient times.

Although bringing water by means of pipes from distant sources was a great improvement, so far as respected an increased quantity; nevertheless, the inconvenience and expense of carrying it from the conduits to each house still existed, and it was not until the erection of the London Bridge Water-works, in 1582, that this difficulty was overcome, when the principle of conveying water into dwelling-houses by means of small lead-pipes was adopted; this, the greatest improvement in the mode of supplying water, by substituting the power of machinery for human drudgery, has not been surpassed, and is the plan now used, two centuries and a half after its first introduction; improvements have been made in the practice of it,—the principle remains unaltered.

London Bridge Water-works.

In 1581, or 1582, Peter Maurice, a Dutchman, obtained a lease of the City of the first arch of London Bridge, on the North side, and erected a water-wheel, to be worked by the tide, and a set of force pumps to raise Thames water for the supply of the neighbourhood. The water was raised to the top of a wooden building 120 feet high, and passed from thence through pipes to supply the dwelling-houses in Thames Street, New Fish Street Hill, and Gracechurch Street, as far as a Standard on Cornhill, which was erected in the middle of the street where the four ways meet. The water which was to spare, after supplying the beforenamed streets, flowed from the Standard through four pipes branching to Bishopsgate, Aldgate, the Bridge, and Wallbrook, which supplied the dwelling-houses in the neighbourhood, and cleansed the gutters in these streets. The site of the Standard was supposed to be the highest ground in the City. The quantity of water raised was equal to about 3,170,000 imperial barrels per annum, or an average quantity of 216 gallons per minute, or about ⅞ths per cent. of the quantity raised by the water-works for the supply of the Metropolis at present. There were 16 pumps worked by this wheel, each 7 inches diameter and 30 inches stroke. Mr. Smeaton ascertained from registers that the pumps made 3025 strokes per tide; and, as there are 708 tides per annum, (allowing one-fifth for loss through the valves, according to Dr. Desagulier's statements,) the quantity raised may be calculated. Improvements, however, had been made before the above particulars of the pumps were published, and therefore the quantity given will be the extreme probable quantity raised in 1582.

In 1583 or 1584 machinery was fixed in the second arch.

Improvements were made and the works continued in Maurice's family until 1701, when they were sold, (after an engagement had been made with the City for a lease of the fourth arch,) to Richard Soams, citizen and goldsmith, for 36,000*l*. Soams formed a company, and divided the property into 300 shares of 500*l*. each. In 1761 machinery was erected in the third arch; in 1767 machinery was erected in the fifth arch, and also in the second arch from the Surrey side for the supply of the Borough. The large wheel erected in the fifth arch by Mr. Smeaton was added in consequence of the reduction in the fall of water occasioned by enlarging the water-way under the bridge when two arches were thrown into one. And about this time an atmospheric engine was erected of ten horses' power to assist the wheels at neap tides, and as a safeguard in case of fire happening in the City at the turn of the tide, when the wheels, of course, could not work.

In consequence of the City being obliged to pen up the water to work the wheels, according to an Act passed in 1756, in the 29th of George II., the blocking up of the arches became such a nuisance to the navigation of the Thames, that an Act was obtained in 1822, the 3rd of George IV., for the removal of the London Bridge Water-works, and they were removed accordingly, and the district was supplied by other companies, chiefly by the New River At the time of the destruction of these works the number of tenants was 10,417, and the quantity of water raised by them was equal to 39,484,000 barrels per annum, or 2704 gallons per minute; showing an increase equal to twelve times the quantity first raised in 1582 by Peter Maurice.

In 1583 two conduits for Thames water were erected near to Old Fish Street Hill.

In 1594, for the better supply of the City, Bevis Bulmar erected a large horse-engine and four pumps at Broken Wharf, to raise Thames water for the inhabitants of Cheapside, St. Paul's Churchyard; Fleet Street, &c., which, Maitland says, was removed previous to the date of his work, 1756, on account of other companies being able to supply water at a cheaper rate.

New River Head Water-works.

The greatest and most splendid work that was ever undertaken for the supply of a modern city with water was commenced in James the First's reign.

In 1605, the 3rd of James the First, the supply of water was found to be inadequate to the wants of an increased population; and as at that time the discovery of the steam-engine had not been made, it was necessary to seek abroad for more powerful springs of water than had hitherto been discovered, and at a sufficient elevation to allow the water to run to London: these were met with in the neighbourhood of Hertford, above twenty miles north of London, and the citizens conceived the vast plan of bringing these springs by means of a channel to Islington, and for that purpose obtained an Act of Parliament, empowering them to bring a stream of water from the springs of Chadwell and Amwell in the county of Hertford, between the towns of Hertford and Ware. By this Act, 3rd of James the First, they were empowered to make a "trench, channel, cut, or river"; the width of the ground to be purchased, being limited to 10 feet; and as these springs were situated in the valley of the river Lee, and, consequently, ran into the said river, they were bound to compensate, not only the owners of property through whose lands the river was to be carried, but also, "all such persons as shall sustain any damage, loss, or hindrance, in their mills standing upon any of the rivers or streams from which the water shall be taken through the said new cut, or river." That this was a proviso of great consequence may be supposed, when at the present day it is stated that one of the springs yields a quantity of water equal to about 3770 imperial gallons per minute, or 54 millions of barrels per annum.

Surveyors were employed by the City to plan the execution of the work; but it was discovered that, as the Act limited the width of the property to be purchased to 10 feet, it would be impossible to convey the waters across the hills and valleys to London: the City therefore applied to Parliament again the following year for power to make tunnels, where necessary, either to be laid in the earth or formed upon arches, and an Act was passed accordingly in the 4th of James the First. Even with these additional powers the course of the river was extremely circuitous, being above 40 miles in length.

Notwithstanding the powers which had been obtained, it appears that the work was not executed until some years after.

In 1608 Sir Hugh Myddleton, citizen and goldsmith, offered at his own charge to carry the Acts of James into execution; and to this great and enterprising man were the inhabitants of the Metropolis indebted for one of the greatest blessings that could be conferred upon any city.

In 1610 the citizens, by an Act of Common Council, made over their powers to Sir Hugh Myddleton; and in 1612 this Act was confirmed by an indenture.

The work, however, appears to have been commenced in 1608, and was completed in 1613.

Maitland states that Mr. Henry Mills, the then engineer to the Company, measured the length of the river accurately in 1723, and found it to be 38¾ miles and 16 poles, to which it was reduced by the contraction of its sinuosities above two miles.

That there were 215 bridges over it, and that it was carried over two valleys in wooden troughs lined with lead, one at Bush-hill, being 660 feet long and 30 feet high; and the other at Highbury, 462 feet long and 17 feet high. He further says, "As this New River is in some places wafted over hills and vales, so in others, mole-like, it forces its way through subterraneous passages, and arriving at the place unjustly called its Head, in the neighbourhood of Islington 'tis ingulfed by 58 main pipes of bores of 7 inches; whereby 'tis conveyed into the several streets, lanes, &c. of the City and suburbs of London, to the great convenience and use of the inhabitants, who, by small leaden pipes of half inch bore, have the water brought into their houses;" the number of tenants amounting in 1756 to 30,000.

It was opened and the water admitted into the basins at the New River Head at Michaelmas, 1613, with great pomp on the day that Sir Thomas Myddleton, brother to Hugh, was elected Lord Mayor.

In 1619 a charter of incoporation was granted by James I. to Sir Hugh Myddleton, citizen and goldsmith, in conjunction with other wealthy citizens, and they were styled "the Governor and Company of the New River brought from Chadwell and Amwell to London." It empowered them to improve the river, to prevent nuisances being committed therein, *under penalty of the King's displeasure*, subject to the laws for the contemners of the King's authority; and, *under the same penalty*, all other parties were prohibited bringing water for the supply of the Cities of London and Westminster, and the Borough of Southwark, without a licence from the Governor and Company of the New River.

The King subscribed towards the undertaking, and was thereby entitled to a moiety of the profits. The work was said to have cost 500,000*l*.: the capital was divided into 72 shares, of which the King had 36; but so poorly did the scheme answer at first, from ignorance of the great advantages that the Metropolis would derive from this splendid work, that Sir Hugh Myddleton, who had spent the whole of his fortune, was ruined, and the proprietors did not for 30 years divide more than 5*l*. per share, or about 1s. 6*d*. per cent. The King, however, who was entitled to a moiety, relinquished his share, reserving only 500*l*. per annum out of it. Although the King's share was in private hands, they took no part in conducting the affairs of the Company.

Previous to the year 1738 the supply from the springs was found to be insufficient, and arrangements were made with the trustees of the river Lee, to enable the New River Company to abstract water from the said river. This was done, first by pipes, and afterwards by a cut and trough into the New River, the dimensions of which were determined by Act of Parliament, passed in 1738, in the 12th year of the reign of George the Second.

This supply, however, was not found to be sufficient, although equal in the aggregate to nearly 17 millions of gallons per diem, or nearly 172 millions of barrels per annum; for in 1822, when the New River Company undertook to supply the London Bridge Water-works districts, it was one of the conditions that they should have a steam-engine to pump from the Thames, in case of failure in the supply of the New River, occasioned by frost or draught; and a 100-horse power engine was accordingly erected at Broken Wharf.

Objections having been made of late years to the water *occasionally* raised by this engine from the Thames, and to the exposed state of the New River, allowing boys to bathe in it, and other nuisances; the Company, upholding the character for enterprise which was bequeathed to them by the great founder of their works, are now applying to Parliament for powers to improve their supply, by relinquishing their station on the banks of the Thames, and in lieu thereof, raising water from the river Lee; and also by fencing in the New River to prevent nuisances being committed therein.

(To be continued.)

BRITISH MUSEUM.—No. V.

(From the Times.)

EGYPTIAN ANTIQUITIES.

THE collection of antiquities in the great saloon of the British Museum, unconnected with the edifices of which they formed part, to the artist are comparatively useless. The monstrosities they represent can neither excite his emulation, nor improve his taste; while to the general visitor they are only regarded as matters of curiosity: he lingers round the mutilated blocks of granite, in vain endeavours to find the meaning of the strange and uncouth figures he sees so innumerably engraved upon them; on turning to the pages of the synopsis, he simply finds the names of Amenothoph, of Rameses, of Ilopth, of Shishak, or of Pthanenoph, and his curiosity remains unsatisfied. A short and more particular description of some of the most important may not be unacceptable.

In the central room a case has lately been opened, in which are two figures, apparently designed to represent a mother and daughter. In beauty of design and execution they are hardly surpassed, if equalled, by any in the collection; they seem to belong neither to the temple nor the tomb, and, whatever they may be called, possess all the appearance of family portraits. They are sitting on a couch, the legs of which terminate in lion's paws, and possess more of the Greek than Roman fashion; the height of the elder figure is 5 feet 6 inches, that of the younger 5 feet 2 inches; in the right hand of the mother, which is extended downwards, is the mysterious instrument resembling a key, called the "Iau," which is commonly a mark of the priesthood; the other, which is singular in Egyptian sculpture, is placed upon the daughter's; the faces of both are handsome, that of the youngest might be thought beautiful; the expression of innocence and modesty is finely pourtrayed; the eyes are large, the lips have nothing of the Ethiopian character, the mouth is beautifully shaped, the nose small and delicately formed, and happiness is thrown over the countenance; the figure is slender, the shape of the bosom and shoulders perfect ; the hair, which is in a thousand curls, covers the ears, and on the forehead is so arranged as to form a tiara; the dress descends nearly to the ancle, and is intended to represent the finest muslin; around the edges of which is an edging apparently of lace; it is crossed over the breast, and passes through a ring, from which is suspended an amulet in shape like a cross; the feet are bare, the hand and arm perfect. A great likeness is observable in the faces of both the figures, but the lips of the elder are thicker, and the nose and face are altogether more Egyptian; the hair of the latter is also curled, but is not so thick as that of the younger, and the ears are shown, in which are earrings; the dress, which is much shorter, is not so full over the person, but equally fine in the texture; on the feet are sandals, the fastenings of which are minutely executed, and are entirely different from the Greek or Roman style. Some remains of colours are to be observed on the dress, blue and red. There does not appear to be any hieroglyphical inscription on it. Immediately under the columns which separate the saloons are two colossal lions which were given by Lord Prudhoe; they are of red Egyptian granite; on each are two tablets or cartouches, on which the learned have read the names of Amenothoph, the second and third; there are also on them two other tablets, the characters of which have not yet been deciphered; they were brought from Nubia, from Delphi, 500 miles beyond the Cataract. The attitude which is given them, although from the locality whence they were removed evidently betokens their great antiquity, is more true to nature than in the generality of similar figures of Egyptian design; one is lying on the right, and the other on its left side; the right fore leg in one is under the body, all but the paw; the left is stretched across the chest, and the paw, turned flat down, rests on that of the right, the under of which is turned upwards; thus the two paws meet like two hands when brought flat together; the eyes are very long, and have much resemblance to those of Egyptian human statues. There are two small lion sphinxes which much resemble these; they were found by Captain Caviglia when he uncovered the sphinx of the Pyramids, in a small temple, placed between its legs; they are of soft calcareous stone, and have been painted red; their length is about 50 inches; one has a head in the style of the sphinx, and on a plinth are some figures, which are no part of the original design, they are not hieroglyphics. Of the other, the lower part of the face is gone; this has also a low head-dress, and a mane carved in lines down the breast, and what is singular, neither of them possesses much of the Egyptian character, though found in such a situation. No. 11 is the figure of a hawkheaded sphinx, which was found by Belzoni at Ipsamboul. The ram's head in this room, which formed the head of a colossal sphinx, was taken from the avenue at Carnac, and is of soft calcareous stone; the face is 3 feet 6 inches in length, and the horn in the curve 4 feet 11 inches, the tip of which is broken off; on the top of the head is an oblong hole, 4½ inches by 4 deep. From the spirit shown in the sculpture of this head, as also in those of the lions, it is to be seen that the Egyptians excelled far more in their delineation of animals than of the human form; that hardness and inanimation, which is the characteristic of the latter, is not to be complained of in the other. What was the origin of the sphinx, and they are found in Europe, Asia, and Africa, what mystery was hidden in so strange a shape, and still wrapped in obscurity, the general opinion of antiquaries, that a lion's head, united to a woman's body, was to denote the rise of the Nile, when the sun is in the signs of Leo and Virgo, will not suit those with a male head or a ram's head. Winkleman thinks the Androsphinx typifies the male and female principles of worship united in one form, and it is so found in India; the Greek sphinx was a female and a lion; the Egyptian and Jewish, a lion with a man's head; in Arracan, it is a female; in Java, half a woman and half an elephant; and in India the fourth incarnation of Vishnu is a man lion. There are in this room two obelisks of black marble; they are the only ones in the Museum; the one on the right as you enter is that mentioned by Niebur in his travels; it has been broken into two pieces; they are now together; the lower part, which is perfect, is about 8 feet in height; it was found fixed into the side of a doorway of a house in Cairo, and the broken part served for a sill; the north side has a cartouche under the usual symbol of the goose and disc, and another perfect, supposed to contain the name; they are repeated on the opposite side, and nowhere else; the hieroglyphics on the north and south sides are the same; those on the east and west are different, but resemble each other; the first are much better executed than the other; the bird is perhaps one of the best specimens of sculpture found in Egypt; the arch on which it is chisseled out is rounded with great skill; the shadow thrown by the edges formed by the erasion in the stone, added to the shadow cast from the rounded part on the deep incision, gives a fine relief to the lighter and higher parts; the feathers of the wing are also beautifully raised, and the eye is well delineated. The one opposite, which is about the same size, is not so well executed; it has the same cartouche cut on the four sides; the hieroglyphics are the same on both of these obelisks, but differently placed; the sistrum is shown on both, and what is supposed to be the proper name on the Alexandrian sarcophagus, as also the prenomen, is the same which appears on these. It was the opinion of Denon that obelisks and gateways which are often found insulated before the temples were votive offerings to the collective gods. The colossal head on which is the mitre, called the Teshr, was found by Belzoni at Carnac, east of the Nile; it is of red granite, and is highly polished, and of much larger dimensions than the one opposite, called the lesser Memnon; the face has much more of the Ethiopian character, and does not possess the softness which is seen in the other, and is evidently of an earlier date; the height from the top of the mitred crown is 10 feet; the beard-case and left ear only are destroyed; the colossal arm lying near it belonged to this statue, and from its being straight and in a falling position shows it must have been an upright one; in the hand are the remains of a staff or sceptre. The cap is fastened with bands under the chin. From the position of the arm and head its height must have been at least 26 feet, and it is observable in this, as in almost all the Egyptian figures, that the ear is placed too high on the head.

The colossal figure marked 21 was discovered in the ruins of a temple behind the Colossi at Thebes, between the Memnonium and Medinet Abu; it is an exact model of the great figure of Memnon at Thebes, the exact height of which is 70 feet; it is in a sitting position, and has a close-fitting cap on the head, on the front of which is the aspic serpent. The beard and lower part of the chin are broken. The stone is a breschia, and looks black, but it is a dark gray, and has bright yellow particles in it, and is the only statue of that kind of stone in the collection. The hair is curiously gathered behind, and, from a number of radii collected in a convex form, is gathered into a long tail; it has a nether garment, of corduroy appearance, attached to a belt round the waist, and overlaps in parts on the thighs, on which are extended the hands, which are badly executed. At the back of the throne is a square column, and the cartouches there inscribed contain, as we are told, the name of Amenothoph or Memnon, being the same as those on the Theban colossus.

A colossal head of Jupiter Ammon, of white stone, marked 30, is finely executed; it was in the collection of Mr. Salt, found by Belzoni, at Carnac. Part of the face is destroyed, but as it remains, the difference of expression observed on viewing it is remarkable. In the front it possesses the general character of Egyptian composure; on the northern side it is grave and severe, and on the eastern it has the same smile as is seen on the face of the lesser Memnon.

Another head of equal size, on the left of the room as you enter, is the only Egyptian one in the Museum on which the beard is seen; in all the others it is placed in a sort of case, but here it is sculptured on the stone; flat lappets descend on each side of the head, the breadth of which are of the same size as the fringy beard. The stone of which it is formed is a brownish breschia, peculiarly difficult to cut. The great sarcophagus on the left, near the entrance, given by Colonel Vyse in 1839, is of red breschia, and is well deserving inspection. The hieroglyphics are highly finished; they are not so numerous as those on the tomb of Alexander, or the one opposite called the Lovers' Fountain, but of better execution. It has a lid of circular form, which fits with a ledge; there is a band of hieroglyphics on each side: in each band are 12 figures 4 inches in length, all different, and divided from each other by a tablet of inscriptions; 11 of these figures are faced by one at the end, a band of hieroglyphics reaches halfway along the cover, another crosses this, and then there are 6 more, 3 of which are but half the length, to give room for 3 figures of mummies, of which there was probably 3 within the monument. Above this there is a face deeply cut, the features of which are completely of the negro character. It has the usual "oskh" or cunicular tippet worn round the neck. The length is 9 feet, and the breadth 3 and a half. The colour of the stone forming the top is much lighter than the lower part of the sarcophagus. No. 10, which is supposed to have been the tomb of Alexander, consists of a single block of stone ten feet in length, four in height, and about five in breadth. It is a particular kind of prismatic conglomerite, resembling that which is under the second porphyry formation, and is entirely covered with hieroglyphics in lines. On his death, we are told by Curtius, his body was enshrined in golden chasework, over which was put a purple vestment, and then his armour: on his arrival at Alexandria it was there deposited, but whether in this sarcophagus or not has been matter of dispute. He was worshipped as the thirteenth god of the Egyptians; three centuries after his death his body was seen by Augustus. Tacitus says the tomb was again opened by Caligula, and the breastplate taken out and worn by him. When the body was removed is unknown, but the Mahometans had always revered and concealed this sarcoghagus from the Christians till seized on by the French.

The engraved tablet of black basalt, called "the Rosetta-stone," the "*crux antiquariorum*," contains three inscriptions—one in hieroglyphics, one in the ancient spoken or enchorial language of Egypt, and the other in Greek. The learned have read, that they record the services which Ptolemy V. had rendered to his country, and that they were engraved by the order of the priesthood assembled at Memphis, for the purpose of investing him with the regal powers. Till the discovery of this stone, which was found by the French in digging the foundation of Fort St. Julian at Rosetta, notwithstanding the labours of Kircher and others, the innumerable inscriptions and the monstrosities which are found engraved or painted on every relict of Egyptian antiquity remained matter of doubt and wonder, and were veiled in the darkness of conjecture. The arrival of this stone was therefore hailed with equal joy by the learned, as would the recovery of the key of an unpickable Bramah by its unhappy loser. Upon the engraving of this block a wondrous system has been raised, which, if it is perfected, is destined to enlighten us in "all the wisdom of the Egyptians," and lay open to the inquiring mind of the 19th century all the knowledge which is thought to be contained in those inscriptions, the amount of which, taken collectively, would fill 10,000 volumes. Some short account of the deciphering system pursued may not, in connexion with the whole of the Egyptian monuments, be unacceptable.

The first author who mentions the writings of the Egyptians says, they had two kinds of characters, one called sacred, and the other popular; but he does not say that they had any affinity with each other. Diodorus Siculus mentions the same, with the addition that the first were peculiar to the priests, and the other was taught to all. Concise as this is, it is all the information these authors give. The next is the celebrated passage in the works of Clemens Alexandrinus, in which the different kinds of writing are given with considerable precision. He says there were three kinds—the Epistolographic, the Hieratic or sacred, and thirdly, the most complete of all, the Hieroglyphic, which he tells us is expressed by means of the first or initial element of words, that is, by reference to the initial sounds of words which denote these objects in the spoken language of the country. Upon this scanty foundation the most extraordinary theories have been built; the six folios of Kircher, according to his interpretation of the hieroglyphical inscriptions, which succeeded equally whether he began at the beginning, the middle, or at the end of the text, are found to be filled with the cabalistic science and strange fancies of a refined system of Dæmonism. The Abbe Pluche has discovered that they are all astronomical, or expressive of the doctrines connected with the science of astronomy, and the division of time in the calendar; and the author of a work entitled *de L'Etude des Hieroglyphiques*, published at Paris in 1812, found in the inscription on the temple at Dendera a translation of the 100th Psalm of David, a foreign language, which most likely the inhabitants of the country never understood. Count Palin has persuaded himself that the hymns of David are but Hebrew translations of the consecrated rolls of Egyptian papyrus. All these fantastic reveries have, however, given way to the system of Dr. Young, the invention of which has been disputed by M. Champollion; he followed the idea of Warburton, that the hieroglyphic or sacred character, was not so called because peculiarly appropriated to sacred subjects, but that they constituted a written language applicable to all the purposes of life, that they were not used to represent things or ideas, but that they represented sounds or words, that they were alphabetical, and that they exhibited things or objects, the common names of which in the spoken language began with the sounds it was wished to express. To make this more intelligible we give the following example:—If there was no other manner of writing than by pictures, or symbols, and the spoken language of England the same as it now is, and it was required to write the name of James, this name being a mere sound could not be intimated to any one by a picture or symbol; but if it was understood that the key of this name was to be obtained by reference to a series of pictures of familiar objects, the names of which in the spoken language begun with the sounds which were successively to be expressed, and which when taken together in that order made up the name, thus, for the sound now expressed by the letter J the figure of a jug or jar was set down, for an A an ape or an acorn, for an M a man or a mouse, and for an S a spear or a spur; the name of James would then by a sort of symbolic acrostic be intimated to all who read the figures in the spoken language. This is the basis of the principle of Dr. Young, De Lacy, and Champollion, and the literati have proceeded upon this to decipher the Egyptian hieroglyphics. To what extent they have succeeded yet remains a matter of doubt; but in consequence the visitor to the Museum, when passing on from viewing the dilapidated remains of Egyptian sculpture in the lower saloon, regretting his ignorance of the strange writing and figures on all of them engraved, is agreeably surprised when he enters the gallery above to recover his mistake; here he finds all is known and deciphered; he reads these are the remains of Pefaakons surnamed Onkhouonnofie, auditor of the Royal palace; that the next is Panamoun, priest of Ammon; that a lady lying near is Iatsbabem, daughter of Petkons, porter of Amoun, and born of Iamaak, lady of the house; he is startled at the immorality; that another is Penamaum, an incense-bearer, son of Ohmofie, son of Hor and of Baenrow, daughter of Saklous; and he supposes that want of space has alone prevented a full account of their lives and actions, easily to be read on their inscriptions, from being given in the synopsis; but he will find on inquiry that serious objections may be raised even to the validity of the names attached, much more to any particular account of their offices or actions.

All the modern expounders of hieroglyphics have raised the structure of their expositions on the trilingual inscription seen on this Rosetta stone, and principally depend upon it. Dr. Young, the most celebrated of them all, did not begin his researches till after its discovery; he knew nothing of it, but from the French account, and it is upon that account alone that the genuineness of the inscription depends; it is true that some other stones with triplicate inscriptions have been found, but that would be the necessary consequence of the first being made: the size and nature of all of them evidently show that they were not in ancient times kept concealed, and if they are so ancient and genuine as we are to believe, why did not the Roman writers go at once to these inscriptions scattered about the country to interpret that which they all regret was lost? It may be said that it would be almost impossible to have forged the inscriptions on this stone, it would only have made the last or Greek one, and when we look at the manufacture of ancient Etruscan vases and cameos in Staffordshire, the tricks of the Parian marbles, the manuscripts of Shakspeare, the copies of Raphael, and read the astounding tale that Professor Houtton, of the Medico Botanical Society, produced a bulbous root found in the cranium of a mummy, in a situation in which it had probably lain 2,000 years, that it germinated when exposed to the atmosphere, though when discovered in a state of perfect dryness, and on being placed in the ground it grew with readiness and vigour, and also know that mummies are manufactured every day, and consider the authority on which it rests, the impossibility of this monument not being genuine is very difficult to believe. In Pompeii articles are constantly buried to be found when wanted, and it has always been observed that the higher the rank of the visitor to those remains the more successful is he in his antiquarian search. There may be 100 Rosetta stones discovered, but the more that are found the more difficult it is to account for the ignorance of Clemens and others on the subject. The plan both of Champollion and Young, of making many phonetic signs for one letter, will make them speak whatever the expositor desires, and proves that arbitrary figures which are not hieroglyphics may be made to give any meaning he may please. If this inscription on the Rosetta stone is genuine, why did not Clemens, who lived at Alexandria, go to it to remove his ignorance, which the passage in his work on the subject proves, and why did not Strabo also? They both could have read the Greek, which the best Scotus can now hardly understand. But what more clearly proves that the meaning of the hieroglyphics was unknown in the Roman times, is the fact, that one of the first emperors offered a reward for the deciphering of those on an obelisk he brought to Rome. The ignorance of Diodorus, Strabo, and Clemens is a pretty good proof that the inscriptions found on the trilingual stones are modern fabrications, else why are so few found, and none on the temples and statues themselves? Whether the French sçavans were the inventors and fabricators is certainly difficult to determine, but that is far more likely than that the authors we have mentioned, and the Roman emperors, should have been ignorant whether hieroglyphics were in use in their time or not. Neither Strabo nor Diodorus says that the hieroglyphics were known in their day; yet if they had been, why have not those authors quoted them in their histories of the Egyptian mythology? It is more than probable that these inscriptions were never intended to be read but by those who had the tradition of their meanings, and that the priests having been massacred in the Persian conquest by Cambyses, that tradition was lost. The same would have been the case with the traditionary learning of the Mexicans had not the Spaniards preserved it. Both Dr. Young and Champollion have found by their process the names of Roman emperors on the same monument with those of the Pharaohs and Ptolomies, in situations where they could not have been erased. How can they account for this? If the names of Ptolemy and Cleopatra, and the Romans, are to be found on the buildings and obelisks written in hieroglyphics, of course they could not have been lost in the time of Strabo and Clemens, yet any one who attentively considers the passage in his work, and that passage is the foundation of all modern explication, must come to the conclusion that the obscurity in which he has enwrapped it was purposely done to conceal his ignorance of that which he pretended to describe.

To the plan of Dr. Young and other learned expositors of reading the hieroglyphics by applying the first letters of Egyptian words of the common vernacular tongue now in use—viz., the Coptic—it would be satisfactory to imply that it must always have remained the same, or nearly so. It is true, we are told nothing changes in the East; but, notwithstanding, it is impossible not to believe but that tongue, admitted to have always been the spoken language of the country, passing through the crucible of conquest by the Ethiopian, the Shepherd Kings, the Israelites, the Persians, the Greeks, the Romans, and the Saracens, during a period of 3,000 years, must have been so dislocated and altered as to have rendered it impossible to read the symbolic or hieroglyphic language of Sesostris in the Coptic or the oldest Coptic books now extant.

RAILWAY CURVES.

In compliance with the request of several members of the profession, we have carefully perused the communications of our correspondents on the subject of railway curves, and, after a careful examination of the various methods therein proposed, we cannot but concur in their opinion, that the question has not yet been satisfactorily settled. We therefore engaged Mr. Aristides Mornay, a gentleman well known for the accuracy of his calculations, to construct a set of tables to facilitate the execution of a plan which we shall presently explain, after having offered a few remarks on the proposals contained in the above mentioned communications, which were published in the Journal during the past year.

In the January number Mr. Murray, under the signature of "A Sub.," proposes as an improvement upon the system of running directly from a straight line to a curve of 1½, 2, or 2½ miles radius, that a curve of 3, 4 or 5 miles radius for a short distance should be made use of to connect them. He adds that projectiles (where the resistance is equal) assume the parabolic curve, to which the plan he proposes is an approximation.

This observation about projectiles is properly answered in the number for March, by "R. W. T.," who also justly observes that "if the curvature is not equable," which would be the case if Mr. Murray's advice were followed, "some parts of it must be sharper than if the same radius were used all through."

In the April number Mr. Ely denies the correctness of "R. W. T.'s" statement, on the ground that Mr. Murray's object is to "begin curving sooner, and make the radii of portions of the curve *greater*." This objection would only obtain, if the object were, besides beginning with a curve of greater radius, to terminate also with a curve of greater radius, which would join the straight continuation of the line farther on than the single curve of uniform radius originally supposed. This however was not Mr. Murray's intention, as is evident from his own diagram and description in the November number. He has assumed a certain point to be arrived at, without considering that the direction of the continuation of the railway is also determined before-hand. These two conditions being given, it is obvious that the junction must either be effected by means of an uniform curve of a radius determined by the given circumstances, or by commencing the curve sooner with a longer radius, and terminating with another of shorter radius.

With respect to the queries of "An Assistant Engineer," in the April number, it appears Mr. Bruff has not exactly comprehended the first, or at least has not expressed himself very clearly. If the case is as represented in "An Assistant Engineer's" diagram, the solution of his problem is impossible: it would be necessary to use a curve of *greater*, instead of *less* radius to join the two given curves. It would, however, be better, if these two curves are indispensable, to connect them by a tangent, as suggested by Mr. Bruff; or, if the two given curves could be altered, it would be still better to increase their radii, so as to make them meet, and form an S curve together. We consider this far better than the plan proposed by "R. W. T.," in the September number, for two reasons: *first*, because the line is shorter, and *secondly*, because the curves are not so sharp. If it were desired to begin one of the curves farther up on the tangent, as recommended by "R. W. T.," the distance to be gone upon the tangent may be found much more easily, and with mathematical correctness by a method which would immediately suggest itself to any one at all conversant with geometry.

We now come to the second query, the solution of which is the main object of these remarks: viz. "Which is the most correct mode of setting out railway curves?" Mr. Foster Charlton's method, recommended by Mr. Bruff, and extracted from "Weale's Scientific Advertiser," is correct; but we do not think it practicable, as it is necessary to construct a triangle of which the lengths of the sides are given, which operation must be exceedingly difficult when two of the sides are several chains in length. "B. W. T.'s" method, given in the May number of our journal, is incorrect, and is not sufficiently explained to enable any one to put it in practice.

The mode described by "Surveyor," in our June number is a correct one, and partly the same as that we propose; but the measurement of the angle contained between the two straight lines to be connected is perfectly unnecessary, and he does not appear to have been prepared with a practical mode of laying off the second tangent.

The method described by our correspondent "M." in the July number, as that usually adopted, besides not being mathematically correct, must be attended with much difficulty in practice, on account of the necessity of constructing triangles whose sides are given; but that proposed as a substitute, although perfectly correct, if the work is accurately performed, is nearly, if not quite as difficult of execution as the former.

It only remains for us now to explain the method we propose for setting out railway curves, which we think will be found to be applicable in all cases, and generally easier of execution than any other *correct* plan. The explanation is illustrated by reference to the accompanying diagram.

Let A″ A be the direction of the railway before curving, and A the point at which the curve is to commence. Produce A″ A to A′, making AA′ any convenient length, and at the point A′ erect the perpendicular (A′ B or offset) on the line AA′, which is a tangent to the required curve, and make A′ B (the offset) equal to the length given in the column *o* of the accompanying tables; B will be a point of the curve. In the figure we suppose the radius of the curve to be a quarter of a mile, or 20 chains, and the tangent AA′, 5 chains. The table gives A′ B=63·5 links. From the point A, measure on the tangent AA′ a distance AB″ equal to the length found in the column *t* of the table, which is in the present case 2 chains 54 links, and through the points B″ and B (already found), draw the straight line B″ B B′, making B B′, which is a new tangent to the curve, equal to A A′, or any other convenient length; set off B′C at right angles to B B′, and equal to A′ B if B B′ was taken equal to A A′, otherwise equal to the length given in the column *o* under the length of tangent equal to BB′. C will be another point of the curve, and by proceeding in the same manner we can determine as many points as may be desired. By taking on any one of the tangents, such as A A′, a number of intermediate points, *a*, *a′*, *a″*, so that A *a*, A *a′*, A *a″* shall be equal to lengths of tangents given in the table, the corresponding offsets, *ab*, *a′b′*, *a″b″*, which are given in the column *o* under the respective lengths of tangents, will serve to determine as many intermediate points of the curve, *b*, *b′*, *b″*, situated between the points A and B. In the figure we have taken B B′ equal to A A′, or 5 chains, but the next tangent, C C′, for want of room, has been made only 3 chains long, so that the offset C′ D is only 22·6 links, as we find in the column *o* under the length of tangent 3 chains. The portions A*a*, BP and C*y* have been made each 2 chains, for which length of tangent we find the offset =10 links, and the other distances P*c*, P′*c′*, P″*c″*, &c. having been taken each equal to 1 chain, the tangents are 3 and 4 chains, and the offsets 22·6 and 40·4 links.

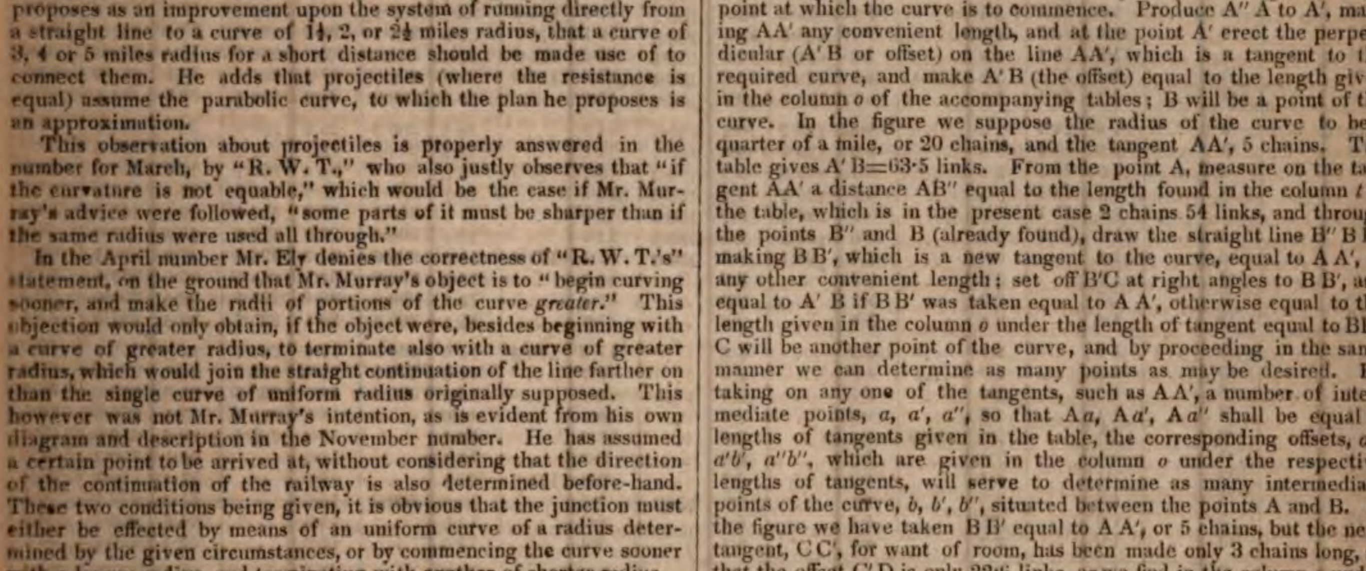


TABLE I.—CURVES FROM 5 CHAINS TO 80 CHAINS, OR ONE MILE RADIUS.

Radius of the Curve.	LENGTH OF THE TANGENT IN CHAINS.																			
	½		1		1½		2		2½		3		3½		4		4½		5	
	t	*o*	*t*	*o*	*t*	*o*	*t*	*o*	*t*	*o*	*t*	*o*	*t*	*o*	*t*	*o*	*t*	*o*	*t*	*o*
Chains.	Links.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.
5	25·1	2·5	50·5	10·1	76·8	23·0	104·4	41·7	134·0	67·0	166·7	100·0	203·2	142·2	250·0	200·0	313·4	282·1	500·0	500·0
6	25·0	2·1	50·4	8·4	76·2	19·1	103·0	34·3	131·0	54·6	160·8	80·4	193·1	112·7	229·2	152·8	270·9	203·1	322·0	268·4
7	..	1·8	50.3	7·2	75·9	16·3	102·2	29·2	129·3	46·2	157·6	67·5	187·6	93·8	219·7	125·5	254·8	163·8	294·4	211·0
8	..	1·6	50·2	6·3	75·7	14·2	101·6	25·4	128·2	40·1	155·7	58·4	184·3	80·6	214·4	107·2	246·3	138·6	280·7	175·4
9	..	1·4	..	5·6	75·6	12·6	101·2	22·5	127·5	35·4	154·4	51·5	182·2	70·8	211·0	93·8	241·2	120·6	275·0	151·7
10	..	1·2	50·1	5·0	75·5	11·3	101·0	20·2	127·0	31·8	153·5	46·1	180·7	63·3	208·7	83·5	237·7	107·0	268·0	134·0
11	..	1·1	..	4·6	75·4	10·3	100·8	18·3	126·6	28·8	152·9	41·7	179·7	57·2	207·1	75·3	235·3	96·3	264·5	120·2
12	..	1·0	..	4·2	75·3	9·5	100·7	16·8	126·4	26·3	152·4	38·1	178·9	52·2	205·9	68·6	233·5	87·6	261·9	109·1
13	..	1·0	..	3·9	75·3	8·7	100·6	15·5	126·2	24·3	152·0	35·1	178·3	48·0	205·0	63·1	232·2	80·4	260·0	100·0
14	..	·9	..	3·6	75·2	8·1	100·5	14·4	126·0	22·5	151·7	32·5	177·8	44·5	204·3	58·4	231·1	74·3	258·5	92·3
15	..	·8	..	3·3	75·2	7·5	100·5	13·4	125·9	21·0	151·5	30·3	177·4	41·4	203·7	54·3	230·3	69·1	257·4	85·8
16	..	·8	..	3·1	75·2	7·1	100·4	12·6	125·8	19·7	151·3	28·4	177·1	38·7	203·2	50·8	229·7	64·6	256·4	80·1
17	..	·7	50·0	2·9	75·1	6·7	100·4	11·8	125·7	18·5	151·2	26·7	176·9	36·4	202·8	47·7	229·1	60·7	255·6	75·2
18	..	·7	..	2·8	75·1	6·3	100·3	11·2	125·6	17·4	151·1	25·2	176·7	34·4	202·5	45·0	228·6	57·2	255·0	70·8
19	..	·7	..	2·6	75·1	5·9	100·3	10·5	125·5	16·5	151·0	23·8	176·5	32·5	202·2	42·6	228·3	54·1	254·5	67·0
20	..	·6	..	2·5	75·1	5·6	100·2	10·0	125·5	15·7	150·9	22·6	176·4	30·9	202·0	40·4	228·0	51·3	254·0	63·5
21	..	·6	..	2·4	75·1	5·4	..	9·5	125·4	14·9	150·8	21·5	176·3	29·4	201·8	38·4	227·7	48·8	253·6	60·4
22	..	·6	..	2·3	75·1	5·1	..	9·1	125·4	14·2	150·7	20·5	176·2	28·0	201·7	36·7	227·5	46·5	253·3	57·6
23	..	·5	..	2·2	75·1	4·9	..	8·7	125·4	13·6	150·6	19·6	176·1	26·8	201·6	35·1	227·2	44·4	253·0	55·0
24	..	·5	..	2·1	75·1	4·7	..	8·3	125·4	13·0	150·6	18·8	176·0	25·7	201·4	33·6	227·0	42·6	252·8	52·7
25	..	·5	..	2·0	75·1	4·5	..	8·0	125·3	12·5	150·5	18·1	175·9	24·6	201·3	32·2	226·8	40·9	252·6	50·5
26	..	·5	..	1·9	75·1	4·3	..	7·7	125·3	12·0	150·5	17·4	175·8	23·7	201·2	31·0	226·7	39·3	252·4	48·5
27	..	·5	..	1·9	75·1	4·2	..	7·4	125·3	11·6	150·5	16·7	175·7	22·8	201·1	29·8	226·6	37·8	252·2	46·7
28	..	·4	..	1·8	75·1	4·0	..	7·2	125·3	11·2	150·5	16·1	175·7	22·0	201·0	28·7	226·5	36·4	252·0	45·0
29	..	·4	..	1·7	75·1	3·9	100·1	6·9	125·2	10·8	150·4	15·5	175·6	21·2	201·0	27·7	226·4	35·1	251·9	43·4
30	..	·4	..	1·7	75·1	3·8	..	6·7	125·2	10·4	150·4	15·0	..	20·5	200·9	26·8	226·3	33·9	251·8	42·0
31	..	·4	..	1·6	75·1	3·6	..	6·5	125·2	10·1	150·4	14·5	..	19·8	200·9	25·9	226·2	32·8	251·7	40·6
32	..	·4	..	1·6	75·1	3·5	..	6·3	125·2	9·8	150·4	14·1	..	19·2	200·8	25·1	226·2	31·8	251·6	39·3
33	..	·4	..	1·5	75·1	3·4	..	6·1	125·2	9·5	150·3	13·7	175·5	18·6	200·8	24·4	226·1	30·8	251·5	38·1
34	..	·4	..	1·5	75·1	3·3	..	5·9	125·2	9·2	150·3	13·3	..	18·1	200·7	23·6	226·0	29·9	251·4	37·0
35	..	·4	..	1·5	75·1	3·2	..	5·7	125·2	8·9	150·3	12·9	..	17·6	200·7	22·9	226·0	29·1	251·3	35·9
36	..	·3	..	1·4	75·0	3·1	..	5·6	125·2	8·6	150·3	12·5	..	17·1	200·6	22·3	225·9	28·3	251·2	34·9
37	..	·3	..	1·4	..	3·0	..	5·4	125·1	8·4	150·2	11·1	175·4	16·6	200·6	21·7	225·8	27·5	251·1	33·9
38	..	·3	..	1·3	..	3·0	..	5·3	..	8·2	..	11·8	..	16·2	200·6	21·1	225·8	26·8	251·1	33·0
39	..	·3	..	1·3	..	2·9	..	5·1	..	8·0	..	11·5	..	15·7	200·5	20·6	225·7	26·1	251·0	32·2
40	..	·3	..	1·3	..	2·8	..	5·0	..	7·8	..	11·3	..	15·3	200·5	20·1	225·7	25·4	251·0	31·4
41	..	·3	..	1·2	..	2·7	..	4·9	..	7·6	..	11·0	175·3	15·0	200·5	19·6	225·7	24·8	250·9	30·6
42	..	·3	..	1·2	..	2·7	..	4·8	..	7·4	..	10·7	..	14·6	200·5	19·1	225·7	24·2	250·9	29·9
43	..	·3	..	1·2	..	2·6	..	4·7	..	7·3	..	10·4	..	14·3	200·4	18·6	225·6	23·6	250·8	29·2
44	..	·3	..	1·1	..	2·6	..	4·6	..	7·1	..	10·2	..	14·0	..	18·2	225·6	23·1	250·8	28·5
45	..	·3	..	1·1	..	2·5	100·0	4·4	..	7·0	..	10·0	..	13·7	..	17·8	225·5	22·6	250·8	27·9
46	..	·3	..	1·1	..	2·4	..	4·3	..	6·8	..	9·8	..	13·4	..	17·4	..	22·1	250·7	27·3
47	..	·3	..	1·1	..	2·4	..	4·2	..	6·7	..	9·6	175·2	13·1	..	17·0	..	21·6	250·7	26·7
48	..	·3	..	1·0	..	2·3	..	4·1	..	6·5	150·1	9·4	..	12·8	200·3	16·7	..	21·2	250·7	26·1
49	..	·3	..	1·0	..	2·3	..	4·1	..	6·4	..	9·2	..	12·5	..	16·3	..	20·8	250·7	25·6
50	..	·3	..	1·0	..	2·2	..	4·0	..	6·3	..	9·0	..	12·3	..	16·0	..	20·4	250·6	25·1
51	..	·2	..	1·0	..	2·2	..	3·9	..	6·1	..	8·8	..	12·0	..	15·7	..	20·0	..	24·6
52	..	·2	..	1·0	..	2·2	..	3·8	..	6·0	..	8·6	..	11·8	..	15·4	225·4	19·6	..	24·1
53	..	·2	..	·9	..	2·1	..	3·8	..	5·9	..	8·5	..	11·5	..	15·1	..	19·2	..	23·6
54	..	·2	..	·9	..	2·1	..	3·7	..	5·8	..	8·3	..	11·3	..	14·8	..	18·8	250·5	23·2
55	..	·2	..	·9	..	2·0	..	3·6	..	5·7	..	8·2	..	11·1	..	14·6	..	18·5	..	22·8
56	..	·2	..	·9	..	2·0	..	3·6	..	5·6	..	8·0	175·1	10·9	200·2	14·3	..	18·2	..	22·4
57	..	·2	..	·9	..	2·0	..	3·5	..	5·5	..	7·9	..	10·7	..	14·0	225·3	17·9	..	22·0
58	..	·2	..	·9	..	1·9	..	3·4	..	5·4	..	7·8	..	10·5	..	13·8	..	17·6	..	21·6
59	..	·2	..	·8	..	1·9	..	3·4	..	5·3	..	7·6	..	10·3	..	13·6	..	17·3	250·4	21·2
60	..	·2	..	·8	..	1·9	..	3·3	..	5·2	..	7·5	..	10·2	..	13·4	..	17·0	..	20·9
61	..	·2	..	·8	..	1·8	..	3·3	..	5·1	..	7·4	..	10·0	..	13·1	..	16·7	..	20·5
62	..	·2	..	·8	..	1·8	..	3·2	..	5·0	..	7·3	..	9·9	..	12·9	..	16·4	..	20·2
63	..	·2	..	·8	..	1·8	..	3·2	..	5·0	..	7·1	..	9·7	..	12·7	..	16·1	..	19·9
64	..	·2	..	·8	..	1·8	..	3·1	..	4·9	..	7·0	..	9·6	..	12·5	..	15·8	..	19·6
65	..	·2	..	·8	..	1·7	..	3·1	..	4·8	..	6·9	..	9·4	..	12·3	..	15·5	..	19·3
66	..	·2	..	·8	..	1·7	..	3·0	125·0	4·7	..	6·8	..	9·3	..	12·1	..	15·3	..	19·0
67	..	·2	..	·7	..	1·7	..	3·0	..	4·7	..	6·7	..	9·1	..	11·9	..	15·1	250·3	18·7
68	..	·2	..	·7	..	1·7	..	2·9	..	4.6	..	6·6	..	9·0	..	11·7	225·2	14·8	..	18·4
69	..	·2	..	·7	..	1·6	..	2·9	..	4.5	..	6·5	..	8·9	..	11·5	..	14·6	..	18·1
70	..	·2	..	·7	..	1·6	..	2·9	..	4.5	..	6·4	..	8·8	..	11·4	..	14·4	..	17·9
71	..	·2	..	·7	..	1·6	..	2·8	..	4·4	..	6·3	..	8·6	..	11·2	..	14·2	..	17·6
72	..	·2	..	·7	..	1·6	..	2·8	..	4·3	..	6·3	..	8·5	..	11·1	..	14·0	..	17·4
73	..	·2	..	·7	..	1·5	..	2·7	..	4·3	..	6·2	..	8·4	..	11·0	..	13·8	..	17·1
74	..	·2	..	·7	..	1·5	..	2·7	..	4·2	..	6·1	..	8·3	..	10·8	..	13·6	..	16·9
75	..	·2	..	·7	..	1·5	..	2·7	..	4·2	..	6·0	..	8·2	200·1	10·7	..	13·4	..	16·7
76	..	·2	..	·7	..	1·5	..	2·6	..	4·1	..	5·9	..	8·1	..	10·5	..	13·2	..	16·4
77	..	·2	..	·6	..	1·5	..	2·6	..	4·1	..	5·8	..	8·0	..	10·4	..	13·0	250·2	16·2
78	..	·2	..	·6	..	1·4	..	2·6	..	4·0	..	5·8	..	7·9	..	10·2	..	12·9	..	16·0
79	..	·2	..	·6	..	1·4	..	2·5	..	4·0	..	5·7	..	7·8	..	10·1	..	12·8	..	15·8
80	..	·2	..	·6	..	1·4	..	2·5	..	3·9	..	5·6	..	7·7	..	10·0	..	12·7	..	15·6

TABLE II.—CURVES FROM 85 CHAINS TO 280 CHAINS, OR 3½ MILES RADIUS.

Radius of the Curve.	Length of the Tangent in Chains.																			
	1		2		3		4		5		6		7		8		9		10	
	t	*o*	*t*	*o*	*t*	*o*	*t*	*o*	*t*	*o*	*t*	*o*	*t*	*o*	*t*	*o*	*t*	*o*	*t*	*o*
Chains.	Links.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.
85	50·0	0·6	100·0	2·4	150·1	5·3	200·1	9·4	250·2	14·7	300·4	21·2	350·6	28·9	400·9	37·7	451·4	47·8	501·7	59·0
90	..	..	..	2·2	150·0	5·0	..	8·9	..	13·9	300·3	20·0	..	27·3	400·8	35·6	451·1	45·1	501·6	55·7
95	..	0·5	..	2·1	..	4·7	..	8·4	..	13·2	..	19·0	350·5	25·9	400·7	33·7	451·0	42·7	501·4	52·8
100	..	..	..	2·0	..	4·5	..	8·0	..	12·5	..	18·0	350·4	24·6	400·6	32·0	450·9	40·6	501·3	50·1
105	..	..	..	1·9	..	4·3	..	7·6	..	11·9	..	17·2	..	23·4	..	30·5	..	38·7	501·1	47·7
110	..	..	..	1·8	..	4·1	..	7·3	250·1	11·4	300·2	16·4	350·3	22·3	400·5	29·1	450·8	36·9	501·0	45·5
115	..	0·4	..	1·7	..	3·9	..	7·0	..	10·9	..	15·7	..	21·3	..	27·8	450·7	35·3	..	43·5
120	..	..	..	..	..	3·8	..	6·7	..	10·4	..	15·0	..	20·4	400·4	26·7	450·6	33·8	500·9	41·7
125	..	..	..	1·6	..	3·6	..	6·4	..	10·0	..	14·4	..	19·6	..	25·6	..	32·4	500·8	40·0
130	..	..	..	1·5	..	3·5	200·0	6·2	..	9·6	..	13·9	..	18·8	..	24·6	450·5	31·1	..	38·5
135	..	..	..	..	..	3·3	..	5·9	..	9·3	300·1	13·3	350·2	18·1	400·3	23·7	..	30·0	500·7	37·1
140	..	..	..	1·4	..	3·2	..	5·7	..	8·9	..	12·9	..	17·5	..	22·9	..	29·0	..	35·8
145	..	0·3	..	..	..	3·1	..	5·5	..	8·6	..	12·4	..	16·9	..	22·1	450·4	28·0	500·6	34·5
150	..	..	..	1·3	..	3·0	..	5·3	..	8·3	..	12·0	..	16·3	..	21·3	..	27·0	..	33·4
155	..	..	..	..	..	2·9	..	5·1	..	8·1	..	11·6	..	15·8	..	20·6	..	26·2	500·5	32·3
160	..	..	..	1·2	..	2·8	..	5·0	250·0	7·8	..	11·3	..	15·3	400·2	20·0	..	25·4	..	31·3
165	..	..	..	..	..	2·7	..	4·8	..	7·6	..	10·9	350·1	14·8	..	19·4	450·3	24·6	500·4	30·3
170	..	..	..	..	..	2·6	..	4·7	..	7·3	..	10·6	..	14·4	..	18·9	..	23·9	..	29·4
175	..	..	..	1·1	..	..	..	4·6	..	7·1	..	10·3	..	14·0	..	18·3	..	23·2	..	28·6
180	..	..	..	..	..	2·5	..	4·4	..	6·9	..	10·0	..	13·6	..	17·8	..	22·5	500·3	27·8
185	..	..	..	..	..	2·4	..	4·3	..	6·7	..	9·7	..	13·2	..	17·3	..	21·9	..	27·1
190	..	..	..	..	..	..	..	4·2	..	6·6	..	9·5	..	12·9	..	16·8	..	21·3	..	26·4
195	..	..	..	1·0	..	2·3	..	4·1	..	6·4	..	9·2	..	12·6	..	16·4	450·2	20·8	..	25·7
200	..	0·2	..	..	..	..	..	4·0	..	6·3	..	9·0	..	12·3	..	16·0	..	20·3	..	25·0
205	..	..	..	..	..	2·2	..	3·9	..	6·1	..	8·8	..	12·0	400·1	15·6	..	19·8	..	24·4
210	..	..	..	..	..	..	..	3·8	..	6·0	..	8·6	..	11·7	..	15·3	..	19·3	..	23·8
215	..	..	..	0·9	..	2·1	..	3·7	..	5·8	..	8·4	..	11·4	..	14·9	..	18·8	..	23·2
220	..	..	..	..	..	..	..	3·6	..	5·7	..	8·2	..	11·1	..	14·6	..	18·4	..	22·7
225	..	..	..	..	..	2·0	..	..	..	5·6	..	8·0	..	10·9	..	14·2	..	18·0	500·2	22·2
230	..	..	..	..	..	..	..	3·5	..	5·4	..	7·8	..	10·7	..	13·9	..	17·6	..	21·7
235	..	..	..	..	..	1·9	..	3·4	..	5·3	..	7·6	..	10·4	..	13·6	..	17·2	..	21·3
240	..	..	..	0·8	..	..	..	3·3	..	5·2	300·0	7·5	..	10·2	..	13·3	..	16·9	..	20·8
245	..	..	..	..	..	1·8	..	..	..	5·1	..	7·3	..	10·0	..	13·0	..	16·6	..	20·4
250	..	..	..	..	..	..	..	3·2	..	5·0	..	7·2	..	9·8	..	12·8	..	16·2	..	20·0
255	..	..	..	..	..	..	..	3·1	..	4·9	..	7·0	..	9·6	..	12·5	450·1	15·9	..	19·6
260	..	..	..	..	..	1·7	..	..	..	4·8	..	6·9	..	9·4	..	12·3	..	15·6	..	19·2
265	..	..	..	0·7	..	..	..	3·0	..	4·7	..	6·8	..	9·2	..	12·1	..	15·3	..	18·8
270	..	..	..	..	..	..	..	..	..	4·6	..	6·7	..	9·0	..	11·8	..	15·0	..	18·5
275	..	..	..	..	..	1·6	..	2·9	..	4·5	..	6·5	..	8·9	..	11·6	..	14·7	..	18·2
280	..	..	..	..	..	..	..	..	..	..	..	6·4	..	8·8	..	11·4	..	14·4	..	17·9

TABLE III.—CURVES FROM 300 CHAINS TO 640 CHAINS, OR 8 MILES RADIUS.

Radius of the Curve.	Length of the Tangent in Chains.																			
	2		4		6		8		10		12		14		16		18		20	
	t	*o*	*t*	*o*	*t*	*o*	*t*	*o*	*t*	*o*	*t*	*o*		*o*	*t*	*o*	*t*	*o*	*t*	*o*
Chains.	Links.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.	Lks.
300	100·0	0·7	200·0	2·7	300·0	6·0	400·1	10·7	500·1	16·7	600·2	24·0	700·4	32·7	800·6	42·7	900·8	54·0	1001·1	66·7
320	..	0·6	..	2·5	..	5·6	..	10·0	..	15·6	..	22·5	700·3	30·6	800·5	40·0	900·7	50·6	1001·0	62·6
340	..	..	..	2·3	..	5·3	..	9·4	..	14·7	..	21·2	..	28·8	800·4	37·7	900·6	47·7	1000·8	58·9
360	..	..	..	2·2	..	5·0	400·0	8·9	..	13·9	..	20·0	700·2	27·2	..	35·6	..	45·0	1000·7	55·6
380	..	0·5	..	2·1	..	4·7	..	8·4	..	13·1	..	19·0	..	25·8	..	33·7	900·5	42·7	..	52·7
400	..	..	..	2·0	..	4·5	..	8·0	..	12·5	600·1	18·0	..	24·5	800·3	32·0	900·4	40·5	1000·6	50·0
420	..	..	..	1·9	..	4·3	..	7·6	..	11·9	..	17·1	..	23·3	..	30·5	..	38·6	..	47·6
440	..	..	..	1·8	..	4·1	..	7·3	..	11·4	..	16·4	..	22·3	800·2	29·1	..	36·8	1000·5	45·5
460	..	0·4	..	1·7	..	3·9	..	7·0	..	10·9	..	15·6	..	21·3	..	27·8	900·3	35·[illegible]	..	43·5
480	..	..	..	..	..	3·8	..	6·7	..	10·4	..	15·0	700·1	20·4	..	26·6	..	33·[illegible]	..	41·7
500	..	..	..	1·6	..	3·6	..	6·4	..	10·0	..	14·4	..	19·6	..	25·6	..	32[illegible]	1000·4	40·0
520	..	..	..	1·5	..	3·5	..	6·2	500·0	9·6	..	13·8	..	18·8	..	24·6	..	31[illegible]	..	38·4
540	..	..	..	..	..	3·3	..	5·9	..	9·2	..	13·3	..	18·1	..	23·7	..	3[illegible]	1000·3	37·0
560	..	..	..	1·4	..	3·2	..	5·7	..	8·9	..	12·8	..	17·5	..	22·9	900·2	[illegible]9	..	35·7
580	..	0·3	..	..	..	3·1	..	5·5	..	8·6	..	12·4	..	16·9	..	22·1	..	[illegible]·9	..	34·5
600	..	..	..	1·3	..	3·0	..	5·3	..	8·3	..	12·0	..	16·3	800·1	21·3	..	27·0	..	33·3
620	..	..	..	..	..	2·9	..	5·2	..	8·1	..	11·6	..	15·8	..	20·6	..	26·1	..	32·3
640	..	..	..	..	..	2·8	..	5·0	..	7·8	..	11·3	..	15·3	..	20·0	..	25·3	1000·2	31·3

THE BUDE LIGHT.

In consequence of a statement in our Journal relative to an accident at Messrs. Hancock and Rixon's, Pall Mall East, caused by the explosion of a bag of oxygen gas, a correspondent of the *Times* sent to that paper a letter, of which we subjoin a copy.

TO THE EDITOR OF THE TIMES.

Sir—In the new number of the *Civil Engineer and Architect's Journal*, there is an account of a fearful explosion of a bag of oxygen at the premises of Messrs. Hancock and Rixon, on the 7th ult., during some experiments on the Bude light. Everything in the room appears to have been shattered to pieces, one person flung into the shop window, another projected up a staircase, and all present more or less injured. The cause of all this seems involved in mystery. It is therefore important that publicity should be given to the affair, that it may be thoroughly investigated, particularly as it is proposed to adopt this light for the Houses of Parliament. It may be recollected by some of your readers that an explosion of oxygen occurred a few months ago at the Lowther Arcade, the cause of which was not satisfactorily stated, though it was conjectured to be owing to its being contained in a Mackintosh bag.

Pure oxygen is considered by chemists to be perfectly inexplosive and uninflammable. Faraday and Gurney have said this in their evidence on lighting the House; therefore some other gas must have been accidentally mixed with it; and what that gas was, and how it got there, it seems at the present moment particularly important to ascertain.

I remain, Sir,
London, Your's obediently,
December 2. J. R.

In reply to this the following letter appeared on the next day in the same paper, from Mr. Goldsworthy Gurney, the Inventor and Patentee of the "*Bude Light.*"

TO THE EDITOR OF THE TIMES.

Sir.—Your paper of this morning contains an exaggerated statement of a gas accident at Messrs. Hancock and Rixon's, said to have been occasioned by the explosion of oxygen, during some experiments on the Bude light. I beg most positively to state, that the accident so erroneously noticed was in no way caused by the Bude light, neither is the cause involved in any mystery, as your correspondent supposes; it was occasioned by common carburetted hydrogen gas. Oxygen used for the Bude light is not inflammable. Coal gas, oil gas, vapour of naptha, or other inflammable aeriform bodies, mixed in certain proportions with the atmosphere, which contains about a quarter part of oxygen, or pure oxygen, becomes explosive; in the Bude light no such mixture ever occurs. In those lamps in which an inflammable gas and oxygen are both used, they are never allowed to come in contact. In the Bude light at the House of Commons no inflammable gas of any description is employed, and explosion of any kind, therefore, as fully borne out by the evidence taken before the committee, is physically impossible.

I am, Sir,
London, Your obedient servant,
December 4. GOLDSWORTHY GURNEY.

It will be seen that Mr. Goldsworthy Gurney's is a flat contradiction of our statement, and we have consequently deemed it advisable to examine into the case more minutely and more critically than we otherwise should have done. Mr. Gurney might have been satisfied with our report, but as he has chosen to designate it an exaggerated one, and to state that the accident was in no way caused by the "Bude Light," we have to inform him that our statement was from an eye witness and sufferer by the accident, whom we have again consulted on the subject, and who positively states that it is in no wise "exaggerated," excepting that part which stated that one of the party was thrown "*into the shop window,*" it should have been *into the counting house*. The remainder of the statement he fully maintains, to be substantially correct; and we will now add a few more particulars to show Mr. Gurney that our information was obtained from a party present. So far are we from having exaggerated, it appears that we have underrated; one gentleman was stunned, and did not recover his senses for some minutes, another was so seriously bruised about the body that he was obliged to be taken to Dr. Stone in Spring Gardens—one of the Messrs. Rixons was also considerably injured—one of the persons had his thigh cut, and indeed the whole party were either more or less seriously injured. The damage done to the premises by the explosion was such, that a compensation has been paid to Messrs. Hancock and Co. by the Insurance Company.

We understand from one of the party that to the best of his recollection the accident occurred in the following manner:—A bag was lying on the floor containing oxygen gas, to which was attached a flexible tube; as the attendant was about to apply the tube to the lighted lamp, he heard some one say "Now put on the weight," but at the instant the tube was being applied to the light, the accident took place, as described by us last month. By the explosion, the bag, which was made of Macintosh's prepared cloth, was completely rent into pieces.

We have also seen some of the other parties who were present, and they all confirm our report of the accident, excepting as to the before mentioned error, that one of the party had been forced into the shop window. The whole affair is so unsatisfactory that we must certainly express our mistrust as to even the alleged causes of the accident.

We shall now give a letter addressed to us by Messrs. Hancock and Co., in which the accident is attributed to carburetted hydrogen.

TO THE EDITOR OF THE CIVIL ENGINEER'S JOURNAL.

Sir—We beg the favour of your inserting the following statement in your Journal, in reply to the exaggerated and incorrect account of the explosion which took place upon our premises, and which appeared in the last month's number, the cause of which was unwarrantably cast upon the Bude light.

The facts are these:—a bag of oxygen gas was sent to us, which had previously been used for carburetted hydrogen, and which had not all been emptied out when the oxygen was put in, there being sufficient hydrogen left in the bag to render it an explosive mixture.

The Bude light can only be produced by pure oxygen, which every one knows is not explosive; and we hope that any stigma that may have been cast upon the Bude light by being the attributed cause of the accident, will now be removed.

We are, Sir,
Your most obedient servants,
HANCOCK, RIXON & DUNT.

After a careful perusal of this letter, can the public be satisfied without having a strict enquiry made into the whole affair? Public safety is too seriously threatened to be thus trifled with. We should like to know how this bag came to be used previously for the purpose of holding Hydrogen Gas,—for we are very fearful that Messrs. Hancock and Co. have been misled upon the subject—witnesses ought to be brought forward who filled the bag with the carburetted hydrogen previously, and to state for what purpose it had been used, and the quantity that was likely to have been left in the bag—at any rate it is undoubtedly a fact that oxygen gas is highly explosive, if it be slightly contaminated with carburetted hydrogen, the same as gunpowder would be if a spark were applied.

Having laid before our readers the above particulars, we will leave it to them to judge whether we are liable to be impugned for the accuracy of our statement. Our own impressions are justified both as to the propriety of demanding an enquiry then, and as to the necessity of its being made now. We entertain no ill will towards Mr. Gurney, but we are bound to justify to the public any attacks upon our editorial character, at the same time that it is our duty to protect the public interests.

ON THE ADHESION OF THE WHEELS OF LOCOMOTIVE ENGINES, by W. R. CASEY, C. E., *of the United States.*

[We are indebted for the following communication to the kindness of its able author, by whom it was prepared for the *American Railroad Journal.*]

POWERFUL locomotive engines will seldom be required for passenger-trains, and, up to this time, the quantity of freight carried over any railroad in the Union, as far as I can ascertain, falls short of 100,000 tons per annum, whilst the average, according to De Gerstner, is only 15,000 tons, carried over each railroad in the country. This is about the one hundredth part of what can very well be done on a well located railway with a single track.

We may however confidently expect that railways will very soon be used for the transportation of freight on a scale sufficiently extensive to prove their capacity for this object. As yet there can be little danger in asserting, that there is not a railroad in the country, which has been located, constructed, and subsequently managed, so as to be even tolerably well adapted to the transportation of a large quantity of freight. The Reading railway will be first in the field to show the power of this new means of communication, and it would be difficult to find a better champion for the cause of railroads. On the Reading road there is, however, no ascending grade in the direction of the greatest trade, and the common 8 or 9 tons engine will easily draw 150 to 200 tons on a level—the greatest resistance offered with the admirable grades of that road; but, where inclinations of from 40 to 60 feet per mile are to be surmounted, engines of that weight are utterly inadequate to the task, whilst heavier or more powerful ones require a more substantial and consequently more costly superstructure.

The question then naturally suggests itself—cannot the power of the engine be increased without an increase of weight? which again immediately leads us to consider, what it is which limits the power of the locomotive steam engine. This is well known to be the friction, or, as it is generally termed, "the adhesion" of the wheel to the rail which all good engines built during the last 4 or 5 years have been able to overcome: that is, where the load was sufficiently great, to make the driving wheels revolve without causing the engine to advance. Strange as it may appear, no experiments have yet been made to determine this all important point, and the "friction of iron on iron" given in treatises on mechanics, as equal to about one-fourth of the weight, has been hitherto used in all *calculations* as the maximum, though numerous well authenticated *performances* have shown, that the ratio of the adhesion to the weight must have been much greater than this. In a pamphlet written so late as year 1838 Messrs. Knight and Latrobe, speaking of a performance of the Stonington locomotive, which showed the adhesion to be equal to $\frac{1}{4\cdot33}$ of the weight, say "As this is greater than we have known in any other case, it is presumed that a portion of the weight of the tender was tranferred to the engine, &c.; but performances of the engines of Baldwin and Norris on the Philadelphia and Columbia railway, long before this pamphlet appeared, go very far beyond this.

In 1836, engines built by Mr. Norris, not exceeding 8 tons in weight, drew loads equal to 400 tons on a level, which, if the weight on the driving wheels was correctly given, showed the adhesion to exceed one-third of the weight. Mr. Baldwin's engines have, however, since exceeded even this, and have drawn loads equal to above 700 tons on a level. Estimating the traction at 10 pounds per ton, this will require a force of 7000 pounds, and the weight on the driving wheels of Mr. Baldwin's first class engines being stated at 12,120 pounds, the adhesion must have been equal to $\frac{1}{1\cdot73}$ of the weight, if this did not exceed 12,120 lbs. or even adding 4000 pounds for the tender, equal to $\frac{1}{2\cdot3}$ of the insistent weight.

After making every reasonable deduction, it appears beyond all doubt, that the adhesion has been very much underrated, and, though this alone keeps the power of locomotives within their present range, I have never heard of a single direct experiment to determine this important law. In the edition of 1831 of Wood on railroads the adhesion is stated at one-twelfth, subsequently it is assumed by Mr. Knight at one-eighth, or "half the friction of iron on iron," which value was not determined by experiment but was merely deduced from the load; so again in the pamphlet already referred to, as late as last year, $\frac{1}{4\cdot33}$ is "greater than we have known in any other case."

Since writing the above, I have seen the experiments of Mr. Rennie on friction, as detailed in the 5th vol. of the Journal of the Franklin Institute, 1830, and he there shows, that there *is* an increase in the ratio with the increase of weight, the surfaces in contact remaining he same. The extreme weights in 11 experiments, [p. 9,] are 1·66 cwt. and 5 cwt. per square inch, and with these pressures, the ratios of the weights to the adhesion are respectively as 4 and 2·44 to 1. The results of the experiments are very irregular, and though in this particular case the ratio varies very nearly as the square roots of the weights, there is nothing to point out the law of increase, so as to enable us to continue the table with any confidence.

On the next page [10] it is stated that with 6·5 cwt. per square inch, cast and wrought iron abrade, and the friction is to the weight as 1 to 2·3. Now, as the weight on the driving wheels is generally 2½ tons on each, as the friction of wrought iron on wrought iron is greater than on cast iron, as this difference is rendered the greatest possible by the parallelism of the fibres of the tire and rail, and as the surfaces in contact can scarcely be one-fourth of a square inch, it is evident, that the power required to produce motion, when the pressure is 2½ tons on a surface of much less than 1 inch square, must be more than $\frac{1}{2\cdot30}$ of the insistent weight. It is stated, [p. 10,] that hardened steel abraded with 10 tons per square inch, but the ratio of the power to the weight is not given.

The laws of friction, are however, only applicable as long as no abrasion takes place, and this falls very far short of the case under consideration, where the pressure is often sufficient to cause even hardened steel to abrade. Still these experiments and numerous performances of the engines of Baldwin or Norris would lead to the conclusion, that the adhesion is at least twice as great as that which Messrs. Knight and Latrobe designate as "greater than we have known in any other case."

"The most interesting performances of locomotives which have fallen under my observation are those detailed in the Franklin Journal of June 1839, where an engine on 8 wheels, constructed by Messrs. Eastwick and Harrison, *started*, on a grade of 27 feet per mile, a load of 265 tons, subsequently overcoming with the same load, a rise of 35 feet per mile. This took place on the bad and crooked road between Broad-street and the Schuylkill-bridge, where the traction must have been 10 pounds per ton on a level, and the entire force exerted by the engine equal to 6600 pounds. In this engine there are *four* driving wheels, on which the weight was 18,059 pounds, showing thus, that the adhesion was equal to one-third of the weight even *with the wheels coupled*. The weight on the driving wheels of Baldwin's engines of the first class, is one-third greater than on *one* pair of driving wheels of the engines of Messrs. E. and H., and any sudden lurch of the engine which, with the ordinary construction, will throw more than half its entire weight on one wheel, will, with these engines, be distributed on two wheels, and there can be little doubt, that an engine with the usual weight on 2 driving wheels, will be more injurious than one with twice that weight on four drivers, as arranged by Messrs. E. and H. Here is an engine which will with ease, draw 100 tons nett, up an ascent of 60 feet per mile, and which requires, on *that* inclination, a superstructure no more substantial than is required by the lightest engines of Baldwin or Norris, on roads varying from a level to 20 or 30 feet per mile—*and this too with anthracite fuel.*

In the interesting pamphlets of Messrs. Knight and Latrobe, already referred to, those gentlemen state that the Camden and Amboy Company "is now building, and have nearly completed, an engine upon 8 wheels, and having two cylinders of 18 inches diameter by a 3 feet stroke; the whole supposed to weigh 18 tons." * * * * "The adhesion upon the rails of all the 8 wheels, is to be brought into action by means of cog-wheels, &c." * * * * "This engine is designed to lead burthen trains at moderate rates of speed; but must be viewed as yet in the light of an experiment."

It is difficult to conceive how such, in other respects, keen observers could pass by with cool indifference the most striking fact related in either of their interesting pamphlets, and which, even without being completely successful, would be attended with results infinitely more important than the benefits resulting from all American improvements in railroads and locomotives united. In illustration, not explanation, it may be proper to observe, that of all the engineers and machinists with whom I have conversed for the last two or three years on this subject, I have only found two engineers [the machinists would not listen to it] who had given the subject that serious attention to which it is, in my humble opinion, pre-eminently entitled. One of these gentlemen, Mr. H. R. Campbell of Philadelphia, showed me, nearly three years since an engine on 8 wheels and 4 drivers, which he was then building to burn anthracite coal, and which certainly bore an astonishing resemblance to the drawings of Messrs. Eastwick and Harrison's engine in the Franklin Journal, and to the advantages of which I have already alluded.

We have seen that with the 8 wheeled engine and 4 wheels coupled, the adhesion was equal to one-third of the weight on the propelling wheels, and if, with the 18 tons engine of Messrs. Stevens, we suppose the adhesion equal to only one-fourth of the weight, we shall have a machine capable of drawing 1000 tons on a level, without greater injury to the superstructure than the ordinary 8 or 9 tons engines of Philadelphia, Baltimore, New York, Lowell, &c. An 8 wheeled engine, weighing 10 tons, acting by the adhesion of its entire weight distributed equally on the 8 wheels, will draw 90 tons nett up an ascent of 60 feet per mile, and there will be no inducement to lessen this weight, as it is only 1¼ tons per wheel, or the same as that on each wheel of an ordinary freight or passenger car, when loaded.

It is well known, that the rapid destruction of wooden rails is not caused so much by the natural decay of the timber consequent on its exposed situation, as by the crushing under the driving wheels of the locomotive, which destroys the lateral cohesion of the fibres of the wood and admits water, the grand agent of decomposition. Notwithstanding this disadvantage, the repairs of the wooden track of the Utica and Schenectady railroad, do not exceed the repairs of the best roads about Boston, (from 300 to 350 dollars per mile per annum, the renewal of the iron being neglected in both cases) and if an engine of 10 tons will not be more injurious to the superstructure, than an ordinary car, it may yet appear, that this improvement *alone*, will reduce the repairs and renewals of the common superstructure, below those of the best road in the Union, omitting the assistance which may reasonably be expected from Kyan's, or some other mode of preserving timber.

It has frequently happened, that horse power has been used for a short time after the opening of a road, by which the nice adjustment of the rails as received from the hands of the engineers, has been little if at all affected. After the road has been travelled by the engine, however, even for a single week, with the very same cars, depressions and inequalities will be found greater, as well as more numerous than those which would be produced by the action of the *cars* only in six months or more. Timber as well as iron will bear a certain strain without the least injury, but a slight increase beyond this, produces a permanent set or deflection, hence, in reducing the weight from 2½ to 1¼ tons per wheel, the relative strength of the superstructure is not merely doubled, but is increased in a much greater ratio. This proportion will be affected by the dimensions of iron and timber, kind of wood, arrangement of parts, nature of earth, &c., but as a general rule it will be greatest where most needed—for instance, when a light superstructure is bedded in clay, in a northern climate.

The distribution of the weight of the engine on 8 wheels, instead of throwing three-fifths or more on 2 wheels, is therefore intimately connected with the continuance of a cheap superstructure, which has been, and will be, even with the present engines, extensively used in many parts of the country, where capital and good mechanics are scarce and timber and axe-men abundant. Owing to the increased deflection of the wooden rail there will of course be a loss of power, but this, even now not very important, will be reduced one-half by the distribution of the weight on all the wheels, besides which the only fear is, that full loads will only too seldom be obtained for the lightest class of engines, built on this principle, even with grades of from 40 to 60 feet per mile.

I have been informed by my friend Mr. E. F. Johnson, (the other engineer alluded to in a preceding paragraph) that a trial of this new engine has been made, and that it appears to work well. Time and experience can however alone develop its powers, expose its defects and give unerring proof of its general and successful adoption. But supposing, what is most unlikely, that this experiment should lead to no useful result, we have still the 8 wheeled engine of Messrs. Eastwick and Harrison (or Mr. H. R. Campbell?) which is capable of drawing 100 tons nett up an inclination of 60 feet per mile, and which will be less injurious to the superstructure than the ordinary 8 or 9 tons English or American engine.

An extremely interesting and still more useful experiment may very easily be made with the engine of Messrs. E. & H., or still better, with that of the Messrs. Stevens. Remove the couplings so that the engine may act by the adhesion of one pair of wheels only, and ascertain the maximum load without slipping the wheels; then couple 2 pair of wheels, repeat the experiment and the increase of load will show the value of the improvement of Messrs. E. & H. With the 8 wheeled engine, 4 such experiments should be made, by which the advantages of this mode of construction would be determined with considerable accuracy, and all requisite information afforded on this vital, and hitherto much neglected principle, of working by the adhesion of more than 2 wheels.

The successful introduction of engines with the weight distributed equally on, and acting by the adhesion of 8 wheels, would form an era in the history of railways in the United States, second only, to that which determined the general question of the practicability of locomotion by steam—in other words, that which gave its present importance to this unrivalled mode of communication.

ON THE DRAUGHT OF CARRIAGES AND ON SECONDARY FRICTION. BY M. DUPUIT, C. E.

(Translated from the French.)

1. DRAUGHT OF CARRIAGES.

BY allowing wheels of diameters varying from 4 feet to 7 feet to run down an inclined plane, and by measuring the spaces run over on horizontal ground, by virtue of the fall, we find that they are proportional to the square roots of the diameters, and height of the fall, whatever may be the weight or breadth of the tire. From this we derive the four following laws:—

The draught is proportionable to the pressure;
independent of the breadth of the tire;
independent of velocity;
in inverse ratio of the square root of the diameter.

These four laws are the same as established by the author of this paper in his Essay on the Draught of Carriages, published in 1837, and which he had found by means of a simple dynamometer. The three last are completely in contradiction to those which M. Morin deduced from the experiments made with his dynamometrical apparatus.

2. SECONDARY FRICTION OF ROLLING.

The resistance which opposes the rolling of a body is nothing more than the molecular action, which takes place on contact. This reaction, always equal to the pressure, passes by the normal when the body is at rest, and advances in front by a certain quantity δ when it rolls; it therefore resists the rolling with a power marked $P\delta$.

Following up this single property of solid bodies, of being an assemblage of molecules in equilibrium, we arrive at the following expression of the friction of rolling:

$$T = \frac{P}{\sqrt{2R}} F\left(\frac{P}{aL\sqrt{2R}}\right),$$

which gives all the properties of this resistance in friction with one of them. If we follow up that of being proportional to the pressure, which is not denied by any one, we rediscover the three other laws pointed out above, which establishes a mutual confirmation of the experiments and the theory. The friction of rolling being an immediate consequence of the imperfect elasticity of bodies, we may, by its properties, ascertain those of elasticity; whence we deduce the following:—

When we subject the surface of a body to pressure, we obtain under this pressure a certain instantaneous sinking e', which reduces itself at last to a slight impression e, when the pressure ceases. This impression e is proportional to the square root of the definitive sinking e'.

The friction of rolling is proportional in the relation of $\frac{e}{\sqrt{e'}}$, in such a way that it is determined by two coefficients which define the elasticity of a body. For want of these two coefficients we may substitute two others. Knowing 1st, The friction of iron upon iron, and of iron upon marble, we may deduce immediately from it the friction of iron upon copper. Thus for twenty surfaces, forty coefficients would be enough to determine 380 to which their combinations two by two would give rise.

When two curved surfaces roll one upon another, the result of the molecular action, equal to the pressure, no longer passes in the direction of the normals, but parallel in the direction of the velocity, at a distance, proportionable to the square root of the product of the rays or radii of curve, divided by their sum or difference, accordingly as they are both convex or one of them concave.

This formula resolves all the problems relating to the calculation of the resistance to rolling, and it is capable of numerous practical applications.

3. ACTION OF WHEELS UPON ROADS.

Although the draught is to a certain point the expression of the derangement of the materials of the road, it is quite inaccurate to conclude therefrom that the degradation is proportional to the draught. By keeping the roads constantly even, which is always possible, the passages are divided uniformly on the whole pavement;* then the small displacements which they occasion destroy each other. Besides in a number of cases the result of the passage of a carriage is to produce an improvement. In a good system of road making, the roads are never degraded, whatever may be the traffic, they are only worn. It cannot be a question, in a road law, of having good or bad roads, but only of spending more or less for their maintenance. Every restriction of the freedom of a road is to the carriers a cause of increased expence, greater than the saving which might be made in the expences of keeping up the roads.

PAPERS ON ARTESIAN WELLS.

Observations undertaken for the purpose of estimating the height to which the Water might rise in the Well bored in the Abattoir de Grenelle, by M. WALFERDIN. *Read before the Academie des Sciences.*

The water which springs up from Artesian sources does not always rise above the level of the soil, sometimes it is several yards lower, and in this case it is brought to the surface by mechanical means; sometimes it reaches it; and at other times it rises more or less above the surface. That as it is well known depends upon the difference of height at which the water arrives across permeable strata, between the impermeable strata which contain it, and that of the point at which they ascend.

I have considered that in the advanced state of the borings at Grenelle, that it might be useful to compare the height at which are filtered the waters which form the supply which is sought under the Paris basin, and that of the surface of the soil at Grenelle.

If, by ascending the natural slope which the waters follow to the surface of the earth, we seek the chalk boundary in the southwest direction, we find it cease in the neighbourhood of Troyes. Then the gault marls and clays which the bore now crosses at Grenelle succeed the chalk, and at about eleven miles from Troyes, near Lusigny, the green sand appears, and forms the orifices by which the waters begin to filter.

The height at which the waters thus penetrate the sands being near Lusigny, 135 or 140 yards above the level of the sea, and that of the surface at Grenelle 40 yards only, it follows that when the bore reaches the layer of water at Paris, that the water will rise sensibly above the surface.

---

* It must be remembered that M. Dupuit is talking of French roads.—ED.

CALCULATING BALANCE FOR ENGINEERS.

BY M. LEO LALANNE, C. E.

(Translated from the French.)

It is often necessary to multiply by each other the terms of two series, and to divide the sum of the products by the sum of one of the series. This calculation, which gives a kind of mean, is that used to find the centre of gravity, to determine certain probabilities, and to solve various questions, which occur in all the mathematical and physical sciences. M. Lalanne has conceived the idea of performing this operation by means of a kind of Roman balance loaded with different weights, and on which the quotients required can be read off on a scale, and obtained with that degree of approximation which allows the representations of numbers by distances and weights.

The plan of this machine is formed on the following considerations:—If we distribute on one of the arms of a balance weight, which are proportional to the terms of a series, and if we place them at distances from the point of suspension, which represent the terms of a second series, if on the second arm of the balance we suspend an equal weight to the sum of the weights already placed on the first arm, it is clear that the distance at which this total weight must be made to act for the equilibrium, will be the sum of the products of the opposed weights, multiplied respectively by their distances from the axis, and divided by the sum of the weights. So much the more exactness will be obtained in this result if the weights and distances are more exactly proportional to the terms of the two series which are to be operated upon, and as the balance is made more sensible.

M. Lalanne intends his instrument principally to assist engineers in calculating the mean distances of transports. We know that in these calculations we must take the sum of the products of the cubes to be transported by the distances which correspond to them, and divide the sum of these products by the total cube. If, then, we take weights which represent partial cubes, and if we place them on one of the arms of the balance, at distances which represent those of the transports; if, at the same time, we place a partial weight on one side of the balance, an equal one is placed in a scale suspended from a very precise point of the other arm, and this point may be moved about until equilibrium is effected, its distance from the axis of suspension will represent the mean distance sought.

In M. Lalanne's balance, the upper part of the beam is divided into 150 compartments, each two millimetres broad; upon it are placed the weights—the distances thus taken from a hundred and fiftieth part nearly up to 600 metres. The volumes are represented by the weight, a cubic metre answering to five milligrammes, a total of 20,000 cubic metres, may easily be operated upon with the approximation of one of these units.

An experiment was made on the comparative duration of the times necessary to obtain a mean by this instrument, and also by ordinary arithmetical calculation—a calculation which required fifty minutes to execute once without verification, was done by the machine in twenty minutes, with only the chance of a very slight error. Thus the time necessary is reduced at least by two fifths, giving besides a security against great errors, and it would be reduced to a quarter if the ordinary arithmetical calculations had been verified. Although the instrument can only give an approximation, and as in all graphic operations, we have not the exact figure of the result, nevertheless the saving of time is great enough to show the utility of it to engineers.

BALISTIC CLOCKS,

FOR ASCERTAINING THE POWER OF GUNPOWDER.

(Translated from the French.)

These clocks were constructed in 1836, in the Arsenal of Metz, the Woolwich of France, by Messieurs Piobert and Morin, and from the nature of the experiments made with them, were formed so as to fulfil the following conditions:—

1st The suspension of the cannon clock must be susceptible of receiving easily and at little expense, cannons and howitzers of every calibre.

2nd The machine must be sufficiently light for its susceptibility to be great enough for small calibres, and small charges, and nevertheless the recoils must not exceed certain limits in heavy charges.

3rd The balistic receiver must be susceptible of receiving without injury, the shock of projectiles of all calibres, propelled with the greatest speed that powder can communicate to them, and be entirely constructed of metal to avoid the effects of hygrometricity and the corrections which it necessitates for wooden clocks.

4th The mechanical requisite of having the centres of oscillation on the line of fire being absolutely necessary for all calibres, required easy means of effecting it.

The detailed reasons which led the inventors to adopt forms almost totally different from those of the old productions of Hutton, and those which had been established at the powder factory of Esquerdes, have been already published by them.

From a summary description of the apparatus, M. Morin shows, by the results of experiments conducted by Captain Didion, Professor at the School of Application at Metz, how great is the accuracy of these instruments. Thus, in the fire of a sixteen-pounder, (about eighteen English,) loaded with a charge of 4lb. 6oz., of four shots fired with charges prepared with care, the speed given to the ball did not differ more than 2 feet 7in, $\frac{1}{580}$ of its mean value, 462·7 metres.

Among other remarkable experiments, these instruments have been used by M. Didion to determine in an accurate manner the charge of powder, beyond which the velocity ceases to increase in 12-pounders (French), and which more than 17½lb., that is to say, much more than the weight of the ball.

Besides, this extraordinary fire, the same apparatus has been used to measure results much superior, since by their means have been ascertained velocities of 660 metres in a second, communicated by particular powder to a 24 pounder shot.

In fine, by firing with a 12-pounder garrison gun, common shells of 12 inch calibre, weighing 4.010 kil., with a charge of 6 kil., they obtained a velocity of 745·3metres in a second, which is the greatest that man has ever yet been able to communicate to moveable bodies.

The machines have satisfactorily answered the purposes for which they were intended, so that the Minister of War has had others made, which have just been set up at the powder works of Bouchet, near Arpajon, and he has ordered a third set for that of Toulouse.

In conclusion, the principle, and general arrangement, of these clocks has been applied by M. Morin to the construction of a wooden clock, of which the receiver closed with a wooden barrel, five feet diameter, will receive the shock of a projectile fired at variable distances of 50, 100, or 150 yards to determine the effects of the resistance of the air. These experiments are already in course of operation by Captain Didion, at Metz, and they afford positive data, and the bases of experimental balistics, so necessary for artillery practice.

PENZANCE HARBOUR.

Extracts from the Report on the improvement of the Harbour of Penzance, by
Henry R. Palmer, F.R.S.

Gentlemen,—In obedience to the instruction of the Town Council, given to me through George D. John, Esq., the Town Clerk, I have endeavoured, as far as lay in my power, to acquaint myself with all those circumstances on which the improvement of your harbour depends; and by a careful consideration of them to prepare such suggestions as I trust may be conformable with your wishes.

The principal observations which I collected referred to an undulatory motion of the water which is invariably felt when the wind is high, and to an occasional "lifting" of the waters arising from distant causes.

The undulating motion of the water is experienced at the extremities of all bays, the beds of which form a gradual slope towards the shore, like that which is under consideration, and the effect can only be reduced by an alteration in the form of the surface, and by a protection from the action of the winds.

It being obvious that the improvement of the harbour must consist mainly in the erection of an additional pier, I was anxious to have the opinions of the nautical men as to the best situation and form of the entrance; and, also, upon the width of the opening. Upon the situation of the entrance southward and northward, there was no important difference of opinion; but it was thought advisable to advance the entrance, if practicable, into deeper water than that at the head of the present pier. The relative positions of the pier head were discussed at some length; and there was a manifest difference of opinion on that point. It is, indeed, one on which it is very difficult to decide *à priori*. I am not acquainted with more than one pier harbour, the entrance to which was so designed originally as to be in all respects satisfactory when carried into effect; and in laying down the plan, which I have now the honour to submit to the council, I have thought it prudent so to arrange the position of the pier heads, as to admit of their being finally adjusted as experience acquired in the progress of the work may dictate.

For the satisfaction of the council, I have deemed it advisable to lay before them plans of other pier harbours. By help of these, some comparisons may be formed with that proposed for Penzance, not only in relation to their extent, but also to their security. They are as follow:—

Ramsgate—Dover—Folkestone—Swansea.

The harbour of Ramsgate is entirely artificial; and is constructed on a shore directly opposed to the prevailing winds. Its security is therefore exclusively derived from the piers by which it is enclosed. The width of the entrance was originally 300 feet, and open due south. The exposure to vessels moored in the harbour, was such as to induce the necessity for an additional protection; and the eastern pier was extended as shown in the drawing, and the width of the entrance reduced to 200 feet exposed directly to the south west, or the most prevalent winds. From this circumstance it may be readily inferred, that, during gales from the quarter last mentioned, Ramsgate harbour offers but little security.

Dover harbour is less exposed than that of Ramsgate, but it is frequently rendered inaccessible by the accumulation of shingle, of which the beach is composed. The direction and position of the piers, which define the entrance to Dover harbour, have been, for the most part, designed with a view to avoid the difficulties arising from the accumulation of the shingle, rather than as a protection against the effect of the winds. The entrance is 150 feet in width, and is open near due S.E.

Folkestone harbour has advantages over all the others on the same coast, in reference to its position. It is the most easily accessible, and is well protected against the effect of the south-westerly winds. It is, however, rendered very imperfect, and the entrance to it sometimes impracticable by the same causes, which so much deteriorated the value of Dover harbour. It is frequently necessary to remove the shingle from the mouth of it by manual labour. But, in other repects, the position of the entrance in relation to the prevailing wind is very favourable. The mouth faces the S.E.E., and is 100 feet in width.

Swansea harbour is the most extensive artificial harbour on the British coast. It is situated in the Bay of Swansea; and has the advantage of a river flowing through it, by which a considerable portion of the bed is cleansed, and its depth preserved. The mouth is 300 feet in width, and is exposed nearly due S.W. The slope of the bed is such as to occasion a considerable ground swell when the wind is strong from the prevailing quarter.

The chief quality of the entrance to Folkestone harbour is derived from the angles of the line of its mouth with that of the prevailing winds. The angle is about 39 degrees, which forms an angle 210 degrees with the line of action of the wind referred to.

The wind against which the most protection is required at Penzance is S.S.E. The angle of the line of entrance as drawn in the plan is 45 degrees with that bearing, or 200 degrees with the line of force. As before observed, the positions of the pier heads are so arranged, that that angle may be increased, if by experience the necessity for so doing may be evinced.

With reference to the width of the entrance of the intended harbour, the same latitude will be preserved as with the direction of it, for it is impossible to determine beforehand with certainty, what width will, under all the circumstances, be most advantageous. In the first place I have assumed 175 feet.

Having adverted to the first and most important point to be decided, I have now to describe the general design for the harbour.

In the first place, I have endeavoured to include as great an area of ground as possible within the limits of the property of the corporation. The northern pier is drawn near about the line of low water of spring tides. Its direction forms an angle of 20 degrees with that of the S.S.E. wind.—The capability of the pier to resist the action of the sea is therefore satisfactory. The surface of the pier is proposed to be 30 feet in width, exclusive of the parapet wall. The pier is proposed to terminate at the northern extremity of the town property.

The pier is proposed to be constructed with granite, and the interior between the walls to be filled with the stones obtained by the excavation in the harbour. A considerable length of the northern portion of the pier need not be walled in the substantial manner required where it is more exposed, and in deeper water. Rubble work, laid with a long slope on the face in the part referred to, will not only be more economical, but will also form a better termination than a perpendicular wall, in as much as it will gradually divert and disperse the action of the sea.

It being the opinion of many of the nautical men that some advantage would be derived by the extension of the southern pier; and considering that the extremity of it may require repair and support, I have proposed an addition to it of 50 feet.

It may be proper here to remark that although I have included by the proposed pier the greatest area available within the limits of the corporation property. the pier as designed will cost a less sum than would have been requisite for a more limited inclosure in the northern direction.

The whole area thus to be enclosed will exceed 40 acres; and there can be no doubt that such a work alone would be one of great value and importance; but still it would be deficient by the total recession of the tidal water from it. The area, however, is such as to allow of a portion being abstracted from it for the purpose of a floating dock. In the plan I have represented a portion so abstracted to the extent of ten acres, a communication being made between the harbour and the dock, by means of a lock, capable of passing vessels of 500 tons burthen.

The division wall is represented near to a lane called Neddy Bettey's Lane. The lock is so placed as to enable vessels to be passed through conveniently and with safety.

It is proposed to form a quay along the boundary of the dock, which will admit of the erection of warehouses, which being built upon arches, will not prevent the traffic of carriages along the quays.

I have not laid down any design for a quay along the front of the town, but, have represented by a dotted line what I conceive should be the limits of a quay if such should hereafter be decided upon.

At the southern extremity of the harbour I have represented a boundary line, including a space which appears to me to be peculiarly suited for a ship yard, in as much as it will be a convenient situation for launching.

In considering the various circumstances affecting the general design, I have had especial reference to the practicable operation of executing it.—This is peculiarly important, where the work is exposed in its progress to the violent action of the sea; and I have no hesitation in stating distinctly that for the execution of the work, with due regard to economy, and to avoid damage to it by the sea whilst it advances, it will be necessary to commence at the northern extremity, and proceed regularly, making all its parts perfect as they are severally produced.

This view of the case constitutes an additional, if not alone a sufficient argument in favour of continuing the sea wall to the point mentioned.

In conclusion, I must beg permission to state that the shortness of the time within which it has been necessary for me to furnish my plan and report has not been permitted me to obtain and furnish them in so complete a state as they should have been presented in.

Certain sections, soundings, and measurements, are necessary, and yet wanting, and, indeed, before the subject can be continued beyond what is necessary for the Parliamentary proceedings, a complete survey made for the particular objects in view will be indispensable; and it will be equally important to obtain a series of observations upon the tides, about which I have not yet been able to collect any precise or valuable information.

In forming an estimate of the expence of the works, I have been obliged, from the absence of sufficient accurate data, to assume a larger consumption of materials than I believe will be required, in order that the error may be on the safe side; and hence, I can, with confidence, state that the sums annexed will be more than sufficient for the execution of the works proposed.

ESTIMATE OF EXPENCE.

Erecting a northern pier, as represented in the drawing. Making an addition of 50 feet to the present pier; and thus constituting a safe and commodious harbour	£24,000
Erecting a cross wall for the construction of a floating dock of ten acres in area, with a ship lock, and tide gates, and swivel bridge, and forming quays along the boundary of the dock	8,500
Parliamentary and law expenses, engineering, &c., say	2,500
	£35,000

ROYAL SOCIETY.—THE PRESIDENT'S ADDRESS.

The following is the address of the President (the Marquis of Northampton), at the meeting of the Society on the 5th ultimo.

Gentlemen—A year having now elasped since you conferred upon me the highly honourable office of your President, it becomes my duty, in accordance with the example of my predecessors, to address you. The first and most agreeable part of my task is to express my feelings of gratitude to those Gentlemen whom you were pleased to select as my Council. * *

The past year has indeed been to that portion of the Royal Society which takes an active part in its affairs, one of more than usual labour and exertion, —of labour and exertion, destined, as I hope, to produce rich and ample fruit. The great and marking peculiarity which has attended it, has been the sailing of the Antarctic Expedition. The importance of following up in the southern regions of the globe the magnetic inquiries so interesting to men of science in Europe, was strongly felt by one of our distinguished Fellows, Major Sabine, and by him brought before the notice of the British Association at their meeting at Newcastle, as he had also previously done at Dublin. That great assemblage of men of science, concurring in the views of Major Sabine, resolved to suggest to Her Majesty's Government the propriety of sending out a scientific expedition; and the Royal Society lost no time in warmly and zealously seconding the recommendation: and, in compliance with the request conveyed to us by the First Lord of the Admiralty, the Council transmitted to the Government a body of hints and instructions in different branches of science, which I trust are likely to be of material use both to the principal and to the subsidiary objects of the Antarctic Expedition. These hints and instructions would have been far less extensive and efficient if the Council had not been able to have recourse to the several Scientific Committees, of whose formation the Society is already aware. The Expedition has now sailed, amply provided with the best scientific instruments, and furnished with ample scientific instructions: it is commanded by one well acquainted both with magnetic inquiry and nautical research. We may therefore hope that, with the blessing of Providence, it will return with a store of knowledge valuable to the geographer, to the geologist, to the meteorologist, and to him also who studies the marvels of vegetable and animal life. In addition to all this we may hope, that the main object of the Expedition will be accomplished by additional light thrown on the obscure problems which still attend the magnetism of the earth, and that by such discoveries Captain James Clark Ross may not only add to his own reputation and his country's glory, but also give to the adventurous mariner increased facility and security in traversing the pathways of the ocean. The Antarctic Expedition was not the only measure recommended by the Royal Society and the British Association to Her Majesty's Government. Another important recommendation, which had previously been brought forward by Baron Humboldt, was the establishment of fixed magnetic observatories for the purpose of making simultaneous observations in different parts of our colonial possessions. These recommendations have been readily acceded to, both by the Government and by the Directors of the East India Company, and probably, ere many months shall have elapsed, the observatories will be in full activity.

I have stated, Gentlemen, that your Council had recourse to the Scientific Committees for assistance in drawing up instructions for the Expedition in different branches of knowledge; those committees, who were named only two years ago, were at first apparently more a matter of form than substance; they have now been found capable of doing excellent service. Not only has your Council consulted them on the questions already alluded to, but also, observing that the several Committees are composed of the most competent judges of the merits of the memoirs in the respective departments of science communicated to the Society, they have, in general, referred the papers to them to report upon previously to coming to a decision regarding their publication. The Royal Society, from its character of pursuing every branch of physical science, is evidently in a different position from other societies professing some one science alone. It may be reasonably expected, that in the Botanical or Geological Society, for instance, the whole Council should possess a certain degree of botanical or geological knowledge. This, however, cannot be the case with us. Our Council will comprise a few astronomers, a few zoologists, a few botanists, and a few persons well acquainted with geology and medicine; but no single science can monopolize a large number of its members. In difficult questions we have therefore felt that it is more satisfactory to ourselves, and we think probably more so to the general body of the society, and to those who have favoured us with papers, that we should ask the opinion of a larger number of men conversant with the immediate sciences in question. At the same time, the Council retains its responsibility for its acts, and the chief officers of the society are officially members of each of the scientific committees. The Council have derived a further assistance from these Committees in the adjudication of our medals. In naming these Committees, the Council has had both a difficult and a delicate task. Convinced that bodies, when too numerous. are little adapted for business, they have also felt that the power of giving their attendance might be more important than absolute superiority of scientific attainments. Some members have, however, been selected, though really non-resident, because it was believed that their colleagues might wish to consult them by letter. With these objects and views, the Council have done their best; but they have little doubt that some gentlemen have been overlooked and omitted, whose presence in the Committees might have been very desirable. The Society must consider this as in some degree a new system, to be perfected and improved by experience alone. Another question has occupied a share of the time of the Council during the last year. We have felt that the testimonial of recommendation for new Fellows has scarcely been sufficiently definite and precise in stating the grounds on which the candidate was recommended to the body of the Society. We have therefore thought it desirable to draw up forms of testimonial, some one of which may be adopted as most fit for each individual so recommended. We have thought this more fair, at the same time, to the meritorious candidate and to those electors who are otherwise left in the dark with respect to his claims for their suffrages. We hope and trust that this new regulation will not stand in the way of any candidate who would be a desirable addition to our number.

The vacancies in the list of our Foreign Members have been supplied by the election of M. Savart of Paris, Signor Melloni of Parma, M. Quetelet of Brussels, M. Hansteen of Christiana, Prof. Agassiz of Neufchatel, and M. von Martius of Münich, as those Fellows who were present at their election will remember.

I have to announce to you, Gentlemen, with great regret, the retirement of Captain Smyth from the office of Foreign Secretary, in consequence of his leaving his present residence for one at an inconvenient distance from London.

I have the honour, Gentlemen, to inform you that the Council have, by an unanimous decision, awarded the Royal Medals to Dr. Martin Barry and Mr. Ivory, and the Copley Medal for the year to Mr. Robert Brown; and I shall now beg leave to address myself to those three Gentlemen.

Dr. Barry.—It gives me sincere pleasure to bestow this medal on a gentleman who has so well deserved it, by researches in a difficult and important portion of animal physiology. Your merits have been appreciated by men much more capable of understanding the subject than I can pretend to be—by men selected by the Council of the Royal Society for their physiological science, who have felt the great value of the discoveries you have made by accurate and diligent research, aided by the skilful use of the microscope. I trust that the award of this medal will encourage you to persevere in the same course, and that future discoveries may add to your reputation and to that of the important profession to which you belong.

Mr. Ivory—It is not the first time that you have been addressed from this chair, and it gives me great satisfaction to follow the steps of my predecessors, Sir Joseph Banks and Sir H. Davy, by again bestowing a medal on one who is an honour to the Royal Society, and pre-eminently distinguished for his mathematical attainments. The labours of your life are too well known to the scientific world to require any eulogium from me, and I consider that in this tribute to your paper on astronomical refraction, we are rather doing an honour to ourselves than to you.

Mr. Brown—In conferring the Copley Medal on you for your valuable discoveries in vegetable impregnation, I am quite sure that the voice of scientific Europe will respond to the decision of the Council of the Royal Society. The Académie des Sciences has already pronounced on your merits, as also on those of Mr. Ivory, by electing you as well as that gentleman to a seat among their foreign members: and the University of Oxford has also, by an honorary degree, given you a similar testimonial. That you are one of our Fellows is to myself a circumstance peculiarly agreeable, as it must be to the whole body over whom I have the honour to preside. Your discoveries in the particular botanical question, for which I have to give you the Copley Medal, are so important, not only in a botanical, but also in a general scientific point of view, by showing the close analogies of animal and vegetable life, that the Committee of Zoology have felt it as much their province as that of the Committee of Botany, to recommend that the Copley Medal should be bestowed upon yon; and the Council have come to an unanimous resolution to give it, though at the same time other gentlemen were recommended by other scientific committees, with whom even an unsuccessful rivalry would be no mean praise. I hope, Mr. Brown, that you may long enjoy life and leisure to pursue researches so valuable to science and so honourable to the country of which you are a native.

In drawing up the following notice of the losses which the Royal Society has sustained during the last year, in conformity with the practice of my predecessors, I have availed myself of the assistance of one of the Fellows, whose acquaintance with the labours of men of science peculiarly qualified him for the execution of a task which I could not myself have ventured to undertake. I therefore will not longer occupy your time by any further remarks of my own, but will conclude by the expression of my present wishes for the prosperity of the Royal Society, and for its success in furthering the noble ends for which it was instituted.

The Rev. Martin Davy was originally a member of the medical profession, which he followed, during a greater part of his life, with no inconsiderable reputation. He became a medical student of Caius College in 1787, and was elected to a fellowship in 1793, and to the mastership in 1803, the late illustrious Dr. Wollaston being one of his competitors. One of the first acts of his administration was to open his College to a more large and liberal competition, by the abolition of some mischievous and unstatutable restrictions, which had been sanctioned by long custom, and also by making academical merit and honours the sole avenue to college preferment: and he lived to witness the complete success of this wise and liberal measure, in the rapid increase of the number of high academical honours which were gained by members of his College, and by the subsequent advancement of many of them to the highest professional rank and eminence. Some years after his accession to the mastership, he took holy orders and commuted the degree of Doctor of Medicine for that of Theology, and in later life he was collated to some considerble ecclesiastical preferments. Dr. Davy had no great acquaintance with the details of accurate science, but he was remarkable for the extent and variety of his attainments in classical and general literature; his conversation was eminently lively and original and not less agreeable from its occasional tendency to somewhat paradoxical, though generally harmless speculations. He died in May last, after a long illness, deeply lamented by a large circle of friends, to whom he was endeared by his many social and other virtues.

Dr. Herbert Marsh, Bishop of Peterborough, and one of the most acute and learned theologians of his age, became a member of St. John's College in the University of Cambridge in the year 1775, and took his B.A. degree in 1780, being second in the list of Wranglers, which was headed by his friend and relation Mr. Thomas Jones, a man whose intellectual powers were of the highest order, and who for many years filled the office of tutor of Trinity College with unequalled success and reputation. Soon after his election to a fellowship, he went to Germany, where he devoted himself during many years to theological and general studies, and first became known to the public as the translator and learned commentator of Michaelis's Introduction to the New Testament. It was during his residence abroad that he published in the German language various tracts in defence of the policy of his own country in the continental wars, and more particularly a very elaborate "History of the Politics of Great Britain and France, from the time of the Conference at Pilnitz to the Declaration of War," a work which produced a marked impression on the state of public opinion in Germany, and for which he received a very considerable pension on the recommendation of Mr. Pitt. In 1807, he was elected Lady Margaret's Professor of Divinity in the University of Cambridge, an appointment of great value and importance, which he retained for the remainder of his life. On the resumption of his residence in the University, he devoted himself with great diligence to the preparation of his lectures on various important branches of Divinity, interposing a great number of occasional publications on the Catholic Question, the Bible Society, and various other subjects of political and theological controversy. In 1816 he was appointed Bishop of Llandaff; and three years afterwards he was translated to the see of Peterborough. * * Dr. Marsh was a man of great learning and very uncommon vigour of mind, and as a writer, remarkable for the great precision of his language and his singular clearness in the statement of his argument.

Professor Rigaud.—The father of the late Professor Rigaud had the care of the King's Observatory at Kew, an appointment which probably influenced the early tastes and predilections of his son. He was admitted a member of Exeter College, Oxford. in 1791, at the early age of sixteen, and continued to reside there as fellow and tutor until 1810, when he was appointed Savilian Professor of Geometry. He afterwards succeeded to the care of the Radcliffe Observatory, and the noble suite of instruments by Bird, with which it is furnished, was augmented, on his recommendation, by a new transit and circle, so as to fit it for the most refined purposes of modern practical astronomy: and we venture to express a hope that it will shortly become equally efficient and useful with the similar establishment which exists in the sister university. Professor Rigaud published in 1831, the miscellaneous works and correspondence of Bradley, to which he afterwards added a very interesting supplement on the astronomical papers of Harriott. In 1838, he published some curious notices of the first publication of the Principia of Newton; and he had also projected a Life of Halley, with a view of rescuing the memory of that great man from much of the obloquy to which it has been exposed; he had made extensive collections for a new edition of the mathematical collections of Pappus: and he was the author of many valuable communications to the Transactions of the Royal Astronomical Society, and to other scientific journals, on various subjects connected with physical and astronomical science. There was probably no other person of his age who was equally learned on all subjects connected with the history and literature of astronomy. He died in London in March last, after a short but painful illness, which he bore with a fortitude and resignation which might have been expected from his gentle, patient, and truly Christian character.

Mr. Wilkins, Professor of Architecture to the Royal Academy—(see Journal, Vol. II. page 388.)

The Rev. Archibald Alison, senior Minister of St. Paul's Chapel, Edinburgh, was born in 1757, became a member of the University of Glasgow in 1772, and of Baliol College, Oxford, in 1775, and the degree of B.C.L. in 1784: he soon afterwards took holy orders in the English Church, and was presented to several ecclesiastical preferments by Sir William Pulteney, Lord Chancellor Loughborough, and Bishop Douglas of Salisbury. In 1784 he married the daughter of the celebrated Dr. John Gregory of Edinburgh, with whom he lived in uninterrupted happiness for forty years of his life. In 1814, he published two volumes of sermons; and at a later period, a very interesting memoir of his accomplished friend the Hon. Fraser Tytler Lord Woodhouslee. Mr. Alison was a man of very pleasing and refined manners, of great cheerfulness and equanimity of temper, of a clear and temperate judgment, and possessing a very extensive knowledge of mankind. He was habitually pious and humble-minded, exhibiting, in the whole tenor of his life, the blessed influence of that Gospel of which he was the ordained minister. All his writings are characterized by that pure and correct taste, the principles of which he had illustrated with so much elegance and beauty.

Edmund Law Lushington was born in 1766, at the lodge of St. Peter's College, Cambridge, of which his grandfather, Bishop Law, was master. He became a student, and afterwards a fellow of Queen's College in that University, and attained the fourth place on the mathematical tripos in 1787. After practising for some years at the bar, he was appointed Chief Justice of Ceylon, a station which he filled for several years with great advantage to that colony. On his return from the East, he was made Auditor of the Exchequer, and also received from his uncle Lord Ellenborough the appointment of Master of the Crown Office. He was an intimate friend of Wollaston and Tennant; and though withdrawn by his pursuits from the active cultivation of science, he continued throughout his life to feel a deep interest in its progress. His acquaintance with classical and general literature was unusually extensive and varied, and he had the happiness of witnessing in his sons the successful cultivation of those studies which other and more absorbing duties had compelled him to abandon. Mr. Lushington was a man of a cheerful temper, of very courteous and pleasing manners, temperate and tolerant in all his opinions, and exemplary in the discharge both of his public and private duties: few persons have ever been more sincerely beloved either by their friends or by the members of their families.

Mr. George Saunders was formerly architect to the British Museum, where he built the Townley Gallery; he was a diligent and learned antiquary, and the author of a very interesting and valuable paper in the twenty-sixth volume of the Archæologia, containing the results of an inquiry concerning the condition and extent of the city of Westminster at various periods of our history.

The only foreign members whom the Royal Society has lost during the last year are the Baron de Prony, one of the most distinguished engineers and mathematicians of the age; and the venerable Pierre Prevost, formerly Professor of Natural Philosophy in the University of Geneva.

Gaspard Clair François Marie Riche de Prony, was born in the department of the Rhone, in 1755, and became a pupil at an early age, of the Ecole des Ponts et Chaussèes, where he pursued his mathematical and other studies with great application, and with more than common success. He was subsequently employed as an adjunct of M. Perronet, the chief of that school, in many important works, and particularly in the restoration of the Port of Dunkirk; and in 1786, he drew up the engineering plan for the erection of the Pont Louis XVI., and was employed in superintending its execution. M. de Prony had already appeared before the public, first as the translator of General Roy's "Account of the Methods employed for the Measurement of the Base on Hounslow Heath," which was the basis of the most considerable geodesical operation which had at that time been undertaken; and subsequently as the author of an essay of considerable merit, "On the Construction of Intermediate Equations of the Second Degree," In 1790 and 1797, appeared his great work in two large volumes, entitled *Nouvelle Architecture Hydraulique*, which is a very complete and systematic treatise on Mechanics, Hydrostatics and Hydraulics, and more particularly on the principles of the steam-engine and hydraulical engineering. In 1792 he was appointed to superintend the Cadastre or great territorial and numerical survey of France—a gigantic undertaking, the subsequent execution of which, during the revolutionary government, combined with the establishment of the bases of the decimal metrical system, gave employment and developement to so many and such important scientific labours and discoveries; among many other laborious duties the formation of the extensive tables devolved upon M. de Prony, who, in the course of two years organized and instructed a numerous body of calculators, and completed the immense *Tables du Cadastre*, which are still preserved in MSS. at the librarv of the Observatory in seventeen enormous folio volumes. M. de Prony became Directeur-General des Ponts et Chausseés in 1794, and was nominated the first Professor of Mechanics to the Ecole Polytechnique—an appointment which led to the publication of many very important memoirs on mechanical and hydraulical subjects, and on various problems of engineering, which appeared in the Journal of that celebrated school. He declined the invitation of Napoleon to become a member of the Institute of Egypt—a refusal which was never entirely forgotten or pardoned. In the beginning of the present century he was engaged in execution of very extensive works connected with the embankments towards the embouchure of the Po, and in the ports of Genoa, Ancona, Pola, Venice, and the Gulf of Spezzia; and in 1810, he was appointed in conjunction with the celebrated Count Fossombroni, of Florence, the head of the *Commissione de l'Agro Romano*, for the more effectual drainage and improvement of the Pontine Mashes. The result of his labours in this very important task, which he prosecuted with extraordinary zeal and success, was embodied in his *Déscription Hydrographique et Historique des Marais Pontins*, which appeared in 1822, which contains a very detailed description of the past, present and prospective conditions of these pestilential regions, and a very elaborate scientific discussion of the general principles which should guide us, in this and all similar cases, in effecting their permanent restoration to healthiness and fertility. After the return of the Bourbons, M. de Prony continued to be employed in various important works, and more particularly in the formation of some extensive embankments towards the mouth of the Rhone. In 1817 he was made a member of the *Bureau des Longitudes*, and in the following year he was elected one of the fifty foreign members of the Royal Society: in 1828 he was created a Baron by Charles X., and was made a peer of France in 1835. He died in great tranquillity at Aonières, near Paris, in July last, in the 84th year of his age. The Baron de Prony was a man of singularly pleasing manners, of very lively conversation, and great evenness of temper. He was one of the most voluminous writers of his age, generally upon mathematical and other subjects connected with his professional pursuits; and though we should not be justified in placing him on the same level with some of the great men with whom he was associated for so many years of his life, yet he is one of those of whom his country may be justly proud, whether we consider the extent and character of his scientific attainments, or the great variety of important practical and useful labours in which his life was spent.

Pierre Prevost was born in 1751, and was originally destined to follow the profession of his father, who was one of the pastors of Geneva. At the age of twenty, however, he abandoned the study of theology for that of law, the steady pursuit of which, in time, gave way to his ardent passion for literature and philosophy: at the age of twenty-two he became private tutor in a Dutch family, and afterwards accepted a similar situation in the family of M. Delesert, first at Lyons, and afterwards at Paris. It was in this latter city that he commenced the publication of his translation of Euripides, beginning with the tragedy of Orestes—a work which made him advantageously known to some of the leading men in that great metropolis of literature, and led to his appointment, in 1780, to the professorship of philosophy in the college of Nobles, and also to a place in the Academy of Berlin, on the invitation of Frederick the Great. Being thus established in a position where the cultivation of literature and philosophy became as much a professional duty as the natural accomplishment of his own wishes and tastes, he commenced a life of more than ordinary literary activity and productiveness. He died on the 8th of April, in the 88th year of his age, surrounded by his family, and deeply regretted by all who knew him.

Use of Varnish of Dextrine in the Fine Arts.—In the sitting of the Academy of Sciences, Monday, 26th August, Baron De Silvestre made the following remarks on the occasion of M. Arago's communication on the preservation of photographic images. He observed that it would be interesting to try dextrine for this purpose, as he himself, for more than two years, had successfully used this substance for varnishing pictures newly painted in oil, water colour drawing, coloured lithographs, and for the permanent fixation of pencil drawings. He had also obtained from dextrine a glue, which he found superseded with advantages all other gluey substances, and particularly mouth glue. In these different applications dextrine is mixed with water in different proportions; two parts to six of water for varnish, and in equal parts for glue. He observed that he always added one part of alcohol in the composition of the varnish, and half a part in that of the glue. The mixture should be always filtered before being used for varnishing pictures and fixing drawings, and in this latter case, a fine wet muslin should be spread over the drawing, before covering it with the mixture of filtered dextrine. The description of these processes, and of the results obtained, is given in the *Bulletin de la Societé d'Encouragement pour l'Industrie Nationale*, for the 2nd of August, 1837.

ANTIQUITIES OF THE CITY OF LONDON.

Sir—Having been called in by the Rector of *Saint Mary Aldermary and Saint Thomas the Apostle*, to inspect the North Wall of the Church of Saint Mary Aldermary, Watling-street, I was led to the following conclusion, after a most careful examination, as to the antiquity of portions of that wall, which may prove interesting to many of your readers.

In rebuilding the church after the memorable fire of London, it seems that Sir Christopher Wren not only retained the original line of the north wall, but finding it unnecessary to pull it down entirely, left it untouched as far up as a string-course which formerly ran along the whole length of the church, under the sills of the windows of the north aisle, traces of it being perfectly discernible to an eye familiar with the remains of antiquity, from the north-east angle of the building to the north doorway. There are also remains of the original basement-moulding, and the original buttresses still exist with the stringcourse profiled round them, they are five in number, and, in one or two places, the face of their ashlar is as perfect as when first worked. The original ashlar of the whole of this wall still remains from the level of the ground to that of the string-course before mentioned, and indeed a small portion of it is left some five or six feet above the string-course, immediately adjoining the easternmost buttress. The rebuilding is clearly defined by the rough masonry of this wall above the level of the string-course, which seems to have been intended at the time as a party-wall between the church and the glebe-houses, not only on account of its not being faced, but also on account of the entire absence of openings for light. The north doorway, with its discharging arch in rough masonry is evidently an insertion in the original wall, the recesses over the doorway seem to have been left as cupboards for the adjoining house, as the masonry of their arches is coeval with that of the discharging arch over the doorway. Before the fire, I have no doubt, this wall was quite unincumbered by buildings, first, because the ashlar still remaining shows a fair face; secondly, because the buttresses still exist, showing also a fair face; and thirdly, because remains of the basement-moulding and the string-course, both being exterior features, can be clearly pointed out. There must therefore have been a space, originally, between the church and the glebe, which seems to have been used as a burial-place, as human bones were some years ago found near the footing of this wall. This space, on account of Watling-street having been either widened at the time or removed farther southwards, (242½ feet were cut off from the glebe land in front towards the street, see Oliver's Survey, vol. 2, p. 155,) was, by the Decrees of the Judges, made part and parcel of the glebe; and this accounts satisfactorily for that wall having been, in the rebuilding, made a party-wall, and also for the right of way having been reserved to the parishioners from the street, through the glebe, up to the north doorway of the church.

I have made a careful drawing of these remains, which I shall be most happy to show to any one who, like myself, may take an interest in old gothic buildings.

Your's, &c.,
Thos. E. Walker.

2, *Keppel-street, Russell-square, Dec.* 3, 1839.

ISLE OF SHEPPY.

Sir—Having read an extract from the Cinque Ports Chronicle in this month's journal, on "The Encroachments and Recessions of the Sea," in which the only reason assigned for the former is the action of the sea in its ceaseless beatings against the shore; I am induced to bring to your notice the Isle of Sheppy, where from another cause the sea is making a more rapid encroachment than perhaps any other part of England: so much so, that I think in a very few years the greater part of Minster Hill, the Station Houses at East End Lane, and Hensbroche will be swallowed up by the sea. Indeed the extent of bank left at low water, particularly during spring tides, and the very great distance from the beach that the stone for cement is dug up, (I *believe* the Rudis Helmontia) prove that the island was once of much greater extent than at present, and from my observation of the land slips that have taken place since I came here in June last, I should certainly say they were caused by underground springs endeavouring to find an outlet, and that by proper drainage much valuable land might be saved. Indeed the shelving beach or strand caused by the former destruction of the island is now a strong natural protection to it, and that the present almost daily loss is owing to want of care in directing the numerous springs into a proper channel.

I am, Sir, your obedient servant,
C. F. Parkinson.
Captain 73rd Regiment.

STEAM BOAT PROPELLERS.

Experiments by George Rennie, Esq., communicated to the Editor of the Railway Magazine.

I herewith send you the average result of a series of experiments I have made on the comparative merits of several instruments which have been tried for propelling vessels through water, under similar circumstances. In order, therefore, to arrive at this knowledge, three different sets of experiments were tried: first, on a model wheel, of two feet in diameter, fixed in a trough of water, and moved by a weight falling through equal height; secondly, by means of a boat to which the different kinds of propeller were adapted, so as to render the circumstances similar in every respect; thirdly, by means of a small steamer, of moderate dimensions, so as to enable the experiments to be made in still water, and thus obtain more accurate results than could possibly be obtained in a tidal river like the Thames. The following are the results on the model—

No. of Experiments.	Diameter of wheel.	Time in seconds.	Area of floats immersed.	Weight suspended.	Area of one float.	
6	2 ft.	15·5	12 in.	4 lbs.	6 in.	Rectangular floats.
6	2 ft.	15·1	9 in.	4 lbs.	3 in.	Trapezium floats.

An experiment was then tried by immersing the rectangular floats to twice their depth. The result was to increase the time of the 4lb. weight falling to 32 seconds, or double the resistance when immersed to the ordinary depth of the float, while the trapezium-shaped float, doubly immersed, only required 16 seconds for the 4lb. weight to fall through the same space; thus, proving the great defect of the paddle-wheel, as applied to all sea-going steam-vessels, so that when deeply laden with coals at the first part of their voyages, the engines can only make half their proper number of strokes. The British Queen, for instance, the engines of which are frequently reduced to nine, instead of seventeen or eighteen, the full number of strokes. These experiments have been repeated again and again, before competent witnesses, and always with the same results.

Secondly—with different kinds of propellers attached to the same boat.

The following are the comparative results:—

Table in which are compared the Performances of the Screw-Propeller, Conoidal-Propeller, and Paddle-wheels.

Distance travelled in feet.	Time in seconds.	Revolution of winch.	Revolution of winch p. min.	Speed of boat in miles p. hour.	Conditions of Experiment.
660	201·0	140·7	42·0	2·2	Screw Propeller, 17 in. diameter, 226 ins. area; revolved with a velocity five times that of the winch.
660	155·25	108·25	41·8	2·8	Paddle-wheel with 12 rectangular floats, each float 9½ × 4; area of floats immersed 228·8 ins.; extreme diameter of wheel, 3 ft. 3 in.
660	155·75	120·75	46·5	2·8	Paddle-wheel, with 12 trapezium-shaped floats (*obtuse* ends down), each float 9½ × 4; area of floats immersed, 103 ins.; extreme diameter of wheel, 3 ft. 6½ ins.
660	153·5	121·75	47·5	·9	Paddle-wheel, with 12 trapezium-shaped floats (*acute* ends down), each float 9½ × 4; area of floats immersed, 107 ins.; extreme diameter of wheel, 3 ft. 10¾ ins.
660	135·5	89·6	39·6	3·3	Conoidal propellers, 17 ins. diameter; 144 ins. area; revolved with a velocity five times that of the winch.

N.B.—The above experiments were made with a boat such as is used in the whale fishery; its length was 27 feet, its breadth 5 feet, its depth 2 feet 1 inch, and its weight, with ballast and persons on board, 2828 lbs., the area of its midship section 483· square inches. In each experiment the winch was driven by two men.

Conclusions.—From the preceding table it appears that the relative merits of the screw propeller, the conoidal propeller, and the common and trapezium-shaped floats are precisely in the order in which they stand in the table; that the screw is inferior to the common paddle-wheel in the ratio of 2·2 to 2·8, with the spear-pointed paddles as 2·2 to 2·9, and with the conoidal propeller as 2·2 to 3·3; that of the trapezium-shaped floats as 2·8 to 2·9, and that with the obtuse angle down is equal. It may be objected to these experiments, that the boat being worked by men, the results cannot be depended upon, on account of the irregular, and, perhaps, over-zealous action of animal power. But, after a few trials, the action soon becomes as regular, and may be calculated upon with nearly the same accuracy, as a steam-engine.

Thirdly—By means of a steam-boat. This boat was kindly lent by the London and Westminster Steam-boat Company; and is of the following dimensions:—

Length	57 feet.
Breadth	6 feet.
Depth	3 feet.

Power—two engines (vibrating) of 5 horse power—36 strokes per minute.

Table in which are compared the Performances of Rectangular and Spear-shaped Floats, with the "Pink" steamer, in the West India Import Dock, in November, 1839.

Distance travelled in feet.	Time in seconds.	Revolutions of cranked shaft.	Revolutions of cranked shaft per. min.	Speed of bôat in miles p. hour.	Conditions of Experiments.
1320	138·	84·0	36·5	6·7	Wheels fitted with 10 rectangular floats 23 × 9 ins. = 207 s. ins.; area of floats immersed, 635·6 s. ins.; extreme diameter of wheel, 7 4.
1320	145·75	87·5	36·0	6·34	Wheels fitted with 10 trapezium-shaped floats (*acute* and *down*), 18 × 11½ = 103·5 s. ins.; area of floats immersed 432·25 ins.; extreme diameter of wheel, 8 10.

Conclusions.—From the results of these experiments we are justified in concluding that the trapezium-shaped float, containing only one-half of the surface of the common paddle, and one-third of its width, will have equal hold of the water, and propel the vessel equally as fast, with a less expenditure of power; but its properties are not only confined to this.

In the first place, they are less weight and first cost, by at least one-half.

Secondly—They present less surface the wind, particularly against a head-wind.

Thirdly—They enter the water without the shock and vibrations which are experienced with the common wheel, and without raising the cascade of water appertaining to the old form of paddle.

Fourthly—They work nearly as well when deeply immersed, with the exception of the slight resistance arising from the edges of the arms.

All which properties have been witnessed and tested by competent judges.

GAS PRODUCED BY A NEW PROCESS.

An experiment in gas-lighting by the Comte de Val Marino was made on Thursday evening on a piece of waste ground at the back of Fetter-lane, in the presence of several scientific gentlemen, who were invited to witness the result. A small gasometer was erected for the purpose, which was connected by tubes with a furnace built of brick, and containing three retorts, one of which was supplied with water from a siphon, another was filled with tar, and both being decomposed in the third retort, formed the sole materials by which the gas was produced. The process appeared to be extremely simple, and the novelty of the experiment consisted in the fact, that the principal agent employed to produce the gas was common water combined with tar; but, according to the theory of the inventor of this new species of gas, any sort of bituminous or fatty matter would answer the purpose equally as well as pitch or tar. After the lapse of about half an hour employed in the experiment, during which time the process was explained to the company, the gas was turned into the burners, and a pure and powerful light was produced, perfectly free from smoke or any unpleasant smell. The purity and intenseness of the flame were tested in a very satisfactory manner, and those who witnessed the experiment appeared perfectly satisfied with the result. The great advantage of this sort of gas over that produced from coal consists, it was said, in the cheapness of the materials employed in its production, the facility with which it is manufactured, and the perfection to which it is at once brought, without the necessity of its undergoing the tedious and expensive process of condensation and purification; for in this instance, as soon as the preliminaries were completed, the light was produced in a perfect state within a few feet of the gasometer, which, although of inferior size, was said to be capable of affording light for 10 hours to at least 500 lamps or burners. With regard to the comparative expense, it was also stated that 1000 cubic feet of gas manufactured by this process, could be supplied to the public for about one third the price now charged by the coal-gas companies; and it was said to be equally available for domestic use, and more safe than the common gas, inasmuch as small gasometers might, at a trifling expense, be fixed at the back of grates in private dwellings, from which the gas could be conveyed in India-rubber bags to any part of the house, thereby preventing the many accidents which occur by the use of tubes and pipes. The Count de Val Marino, who has conquered the difficulty hitherto experienced in bringing this species of gas into use, superintended the arrangements, and evinced a natural anxiety to bring his experiment to a successful issue. He has taken out a patent for his discovery, and he has improved upon the burners now in use, so as to render the light produced more pure and intense. For this improvement he is also secured by a patent. How far gas of this description can be brought into general use, or whether in point of economy the public would be benefited by its adoption, are questions which we have not the means of deciding, and, without hazarding any opinion on the subject, we can only say that the experiment, as far as it was tried in this instance, appeared to be quite successful.—*Times.*

AMERICAN PATENTS.

(From the Journal of the Franklin Institute.)

For "*An improved Eccentric Brake, for arresting the motion of Railroad Cars.*" Ephraim Morris, Bloomfield, Essex county, New Jersey, Sept. 19.

Between the two wheels on each side of a car there is to be a cam wheel, one part of which is to be a segment of a circle, resembling the periphery of one of the wheels; another portion of the periphery of the cam is in a straight line, probably of two feet or more in length, and the cam may be made to roll round on its circular, or curved part, and to bring this straight part upon the rail, which, whilst it bears upon it, will lift the wheels, at one or both ends, therefrom. The straight portion of the cams are furnished with flanches which embrace the rail. This part, by its friction upon the rail, is to operate as a brake upon an inclined plane, or elsewhere. The claim is to the foregoing arrangement of the respective parts.

When it is desired to relieve the brake, this is effected by backing the cars, when the ordinary wheels are made to rest upon the rail, the lower side of the brake being then free from them; there are, of course, some particular devices described which we have not noticed, nor do we think it necessary, being apprehensive that the contrivance is not destined to be adopted.

For "*A Machine for cutting the Teeth of Circular Saws.*" Thaddeus Sellick, Haverstraw, Rockland county, New York, September 19.

One, two, or more, steel plates, prepared to have teeth cut upon them, are to be placed upon a vertical spindle capable of revolving on its two ends. These plates are to be made to bear against a revolving cutter, consisting of an endless screw, the thread of which is in such form as to cut a saw tooth. A cutter two inches in diameter and half an inch in thickness, has been used for the purpose. The revolution of the cutter will cause that of the saw plates, which are borne up against it. It is remarked that the teeth of straight saws may be cut by a similar device.

"What I claim, is the employment of a circular revolving cutter, having a thread or channel on its periphery, running in the manner of an endless screw. and so arranged and combined with the other parts of the machinery employed, as to cause the cutter to cut, and to feed the plates to itself, by its own action, the whole operating substantially in the manner above set forth."

For "*An Improvement in the mode of preserving Timber.*" Edward Earl, Savannah, Georgia, September 20.

We published in our last number, the specification of a patent for a similar purpose, the gentleman above named being one of the patentees. The mode of procedure in the present case is like that described in the former patent; that is, the timber is to be boiled in the solution by which the preservative quality is to be communicated, which solution is to consist of sulphate of copper, (blue vitriol,) and sulphate of iron, (copperas,) dissolved in water. One part of sulphate of copper to three of sulphate of iron, are to be taken, and about three pounds of the mixed salts added to every gallon of water. The timber after being bored through its length, is to be boiled, and afterwards suffered to cool in this solution. The claims made, are to "the boiling of timber as described, in a solution of sulphates of iron and of copper; applying this solution to the interior as well as the exterior of the timber, by means of the central perforation when the size of the timber requires it, as the most effectual mode of protecting it from the ravages of insects, and of rot. I do not claim the saturating of timber by a solution of sulphates in water when applied cold, but confine my claim to boiling it, as above set forth, in that solution, during from two to five or six hours, or more."

For "*A Gravel Pump.*" Laura Rice, administratrix of J. J. Rice, and Ebenezer Rice, Salina, New York, August 15.

"This pump, or machine, is inserted in a well, or shaft, which should be properly tubed with cast or sheet iron, or other proper material, with space to permit it to pass readily, and having a rope, or cords, connected with the end of the piston, is worked in the manner of a pump until sufficiently charged with the substance to be removed, when it is raised by a windlass, or other power. It is particularly adapted to the excavations of shafts for brine, and was discovered whilst excavating wells for that purpose, as no instrument was known which would readily raise the gravel from the beds without great delay and difficulty, and at the same time leave the sides of the well bare and pervious to the transmission of brine, the ordinary process of drilling merely crowding the staves from the shaft, and rendering the sides of the well compact, hard, and nearly excluding the passage of small streams of brine into the well."

The form of the exterior of the machine is that of two cylinders differing in size, the smaller standing above the larger; the lower cylinder is to be about 11 or 12 inches in diameter, and 21 in height; the upper one may be 8½ inches in diameter, and 15 in height; they are connected by an offset, are hollow, and made of cast iron; the upper cylinder forms a pump chamber in which a piston is to work. The lower cylinder constitutes a receiver to retain the sand and gravel drawn into it by the action of the pump. In the bottom of the lower cylinder there is a round opening of six inches in diameter, and the upper and inner edge of this opening is surrounded by pieces of whalebone, or other elastic material, which rise from it so as to form a cone somewhat like that of the pointed converging wires in some rat traps; these may be six or seven inches long. They allow of the passage of stones and gravel into the chamber, and prevent their return. This elastic material is surrounded by a sleeve of cloth, which admits sand to pass up and around it.

The claim is to "the manner of connecting and combining the respective parts of the above described machine, for the purpose of excavating wells and shafts, and the removal of sand and gravel therefrom; that is to say, the combination of the exhausting apparatus with the cylinder, the conical bars of whalebone or other material, and the canvas surrounding the same, constructed and operating in the manner set forth."

PRESERVING TIMBER BY LIME WATER.

Specification of a Patent for an improvement in the mode of preserving Timber. Granted to Samuel Ringgold, of Florida, and Edward Earle, of Savannah, State of Georgia, Aug. 6, 1838.

(From the Franklin Journal.)

The nature of our invention consists in applying heat, by boiling in strong lime-water, to the interior as well as to the exterior of timber, according to the size and kind of timber, and the use in which it is to be employed may admit, or require, for the destruction and prevention of worms in it, and for the correction or removal of the corruptible sap, and the occupation of its place by a preservative substance.

We first bore the timber, if it be of a size sufficient to admit of it, through the centre, making the perforation of a calibre proportioned to the size of the piece, say from half an inch to an inch and a half, or two inches. Then we boil it in strong lime water for a length of time proportioned to its size, as four to six hours, if it be twelve inches square, and so in proportion to its substance; and when the timber has had the heat and fluid conveyed through its whole substance, it is to be removed to a shed, where, protected from the sun and wind, it may gradually dry. Finally, before it is used, the perforation through the centre is to be completely filled with dry lime, or with petroleum, or coal tar, as the purpose for which it is intended may make preferable, and plugged by wood of the same kind, and prepared in the same manner. Also, if the use to which the timber is destined be such as to admit of it, the exterior may be payed, or coated with hot petroleum, or coal tar.

What we claim as our invention, and desire to secure by letters patent, is the boiling of timber in lime water, as above set forth. We apply the fluid to the interior as well as exterior of the timber, by means of the central perforation, when the size of the timber requires it, as the most effectual mode of preserving it from the ravages of insects, and from rot. We do not claim the saturating of timber by a solution of lime in water when applied cold, or when heated by that heat which is generated in the slacking of the lime, but confine our claim to the boiling it in lime water during one, two, three, or more hours.

Remarks by the Editor.—The plan of impregnating timber with lime, by soaking it in lime water, is quite old, but we have never yet seen any evidence of its utility. This is an assumed effect, but one which, we believe, yet remains to be proved. The only substantial difference in the plan above proposed, and that formerly assayed, is in the boiling process, and this we think of a very doubtful utility. Timber may be rapidly seasoned by boiling, the moisture within it being converted into vapour, and consequently escaping through the pores, a condition not the most favourable to the entrance of a solution; the allowing it to cool in and with the liquor, might probably promote saturation. There is another fact of some importance in the process, provided the thing itself is of any value, namely, that the colder the water the greater is the quantity of lime held in solution, and of course more would enter the pores in a cold than in a heated vessel. It is not worth while, however, to extend our speculations upon the best mode of getting the lime in until we have ascertained the fact that when it is there it will produce some good result.

HER MAJESTY'S DOCK-YARD, WOOLWICH.

Extensive works are at present in operation at the west end of the yard, for the formation of a large graving dock, which is to afford accommodation to the first class government steamers. The site for the new dock is the south side of the basin or wet dock, which is principally used for fitting out steamers; the situation thus chosen allows of room for another dock of like dimensions being constructed to the eastward of it, in the event of such extended accommodation being required. The works, which are contracted for, and being executed by, Messrs. Grissell and Peto, under the direction of Mr. Walker, the engineer, are of great magnitude, comprising likewise the formation of a wall across the entrance to the old concrete dock, which was undertaken by Mr. Ranger, and constructed of his patent concrete; this material was not found sufficient to keep down the land springs, and has, consequently, been relinquished. For the formation of the new dock, a cofferdam has been constructed in front of the proposed entrance, nearly a hundred feet in length, consisting of parallel rows of close piling driven into the solid ground, as that portion of the basin wall within the cofferdam will necessarily have to be removed, great strength is required in the framing of the timbers for its support, which appears to have been amply provided for by the excellent arrangement of shoring adopted. Considerable progress has been made with the excavation for the dock, which has been taken out for nearly its entire surface, to a depth of from twenty to thirty feet below the quay level; to prevent the slopes of the excavation from slipping, and likewise to save room, the whole area of the dock is being enclosed with sheet piling, which, as the masonry of the side walls advances, will be removed if found advisable. The dock will be constructed of granite, either from the New Granite Co.'s quarries, near Plymouth, or from the Haytor quarries in Devonshire. A large quantity of stone is now upon the ground partly worked. The length of the dock will be 265 feet from the semicircular head to the inside of the gates, the width at top 80 feet and at bottom 37 feet, the clear width at the entrance 65 feet, the depth 26 feet from the quay level to the invert, being equal to 22 feet depth of water at high water, Trinity standard; the entrance gates and plan of working them will be according to the most approved construction.

The sides of the dock will be formed in steps or altars, varying in height from nine to sixteen inches, and in width from nine to fifteen inches, with the exception of one called the Broad Altar, about midway down which will be eighteen inches in width; the object of these altars is for the convenience of placing the shores against the hull of a vessel at any height, and for resting the ends of spars for staging; that called the Broad Altar is made wider than the others, for walking upon in examining the sides of the vessel under repair; the curve given to the altars is calculated to suit nearly the form of a vessel, and likewise affords, as before stated, the opportunity of shoring at any height, which is precluded by the common form of docks where very deep altars are used, and they will also enable the workmen to get up and down at any part of the dock with great facility, but for general purposes, a staircase of more easy ascent will be constructed at the head of the dock; slips for letting down and raising timber, &c., will be formed at the head, and likewise on each side of the dock. The stones of the invert forming the bottom of the dock will radiate, as likewise the altar stones as high as the Broad Altar, the whole thus forming an arch to resist the upward pressure, and the masonry above, as likewise the coping, will be in stones of large dimensions, the whole backed with brickwork and concrete. The walls at top will be four feet thick, and at bottom 25 feet 6 inches, and the total width of the foundations will be 88 feet, under which a body of concrete three yards thick will be carried down to the gravel. The apron at the entrance will be supported upon bearing piles, and protected in front with sheet piling made water-tight. As an engine and pumps will be required for emptying the dock, a pumping engine is now being constructed by Messrs. Bolton and Watt, and will be fixed ready for working by the time the dock is finished, Large brick culverts, furnished with proper penstocks, will be formed for drainage to the engine-well, and also for filling the dock when required for floating a vessel out. During the works, the large area excavated for the dock will be kept clear of water by a temporary engine and pumps, which are in course of erection. From the above some idea may be formed of the magnitude and importance of the works now in progress at Woolwich Dock Yard, which, with other improvements now being executed under the direction of Captain Brandreth and Lieut. Dennison, of which we hope shortly to give an account, will render this yard a very complete establishment for that important department of Her Majesty's navy, the steam marine. We will endeavour, at some future opportunity, to give further particulars of these interesting works during their progress.

Peterboro'.—The Justices for this liberty, at their meeting on Saturday the 30th ult., adopted the plans of Mr. Dunthorne, of Hanover-street, London, for the new gaol about to be erected for this liberty. Many very meritorious plans were sent for the inspection of the Justices: and amongst them, those of Mr. Sibley, of Great Ormond-street, and Mr. Alexander, of Adam-street, Adelphi, London, and of Mr. Walter, of Cambridge, elicited the greatest approbation. Mr. Blore, who is erroneously stated by a cotemporary to have been the successful candidate, did not send in a design.—*Stamford Mercury.*

ON THE POWER OF THE STEAM ENGINE.

At the last meeting of the Cornwall Polytechnic Society, held at Falmouth, Mr. Snow Harris read an abstract of an interesting and valuable paper on the Steam-engine, by Professor Moseley, he passed a high eulogium on that gentleman whose paper, he said, possessed a great deal of interest to the working engineer and practical miner. The details of the paper would, however, be too tedious to bring before a mixed audience, and he had therefore abstracted the principal points which it was necessary to bring under their considertion. Professor Moseley appeared to think that the efficiency of a steam engine could be measured only by observations of the cylinder itself, because the estimate at any other place was less than the actual deficiency on account of friction and other causes. Hence they could not tell *à priori* of what the engine was capable. If they had a good measurement of the efficiency at the cylinder, and also of the work actually performed, they should then arrive at a true estimate of the power of the engine, and also of the loss by friction, &c., by subtracting one from the other. In the Cornish engines they had already the efficiency of the working parts; they required, therefore, the only observations at the cylinder. It was the difference of these which was the efficiency for the pit work, and of so much importance to the adventurer and engineer. Professor Moseley proposed to arrive at the efficiency of the cylinder by connecting a second smaller cylinder with it of about six inches diameter, so as to allow of the steam acting upon a spring through the medium of a solid plug in the latter. The writer thought the effective pressure upon this plug as indicated by the quantitatum measurement by means of the steel spring will be always equal to that upon an equal area of the piston of the engine; so that knowing one of these pressures they could always determine the other—namely, the effective pressure. The author proceeded to explain by diagrams a practical method of carrying out his general principle. He further thought that they not only wanted to know the effective pressure throughout the whole duration of the stroke, but also how much of the stroke was described under any given pressure. The author furnished methods for arriving at this important element which were well worthy of attention, and were such as to apply either to a long period as a month, or a short period of six hours. The Professor considered that the *out* as well as the *in* stroke should be registered, and he gave an arrangement for the purpose, and the results were registered upon indicator diagrams, different from those of Watt, and upon an area sixty times as great. There seemed but little doubt that the author of this paper, which must be considered as an extremely important one to the practical miner and engineer, had succeeded in inventing methods for arriving at the efficient power of the steam engine. It was the mechanical details which required consideration. They must obtain very perfect springs calculated to yield through spaces proportioned to the pressures. This was a vital affair, for should not such be the case the indications would be erroneous. The author thought that this property could be given to spiral springs, as well as to bow springs of a given form; and that with due correction for the friction of the small cylinder, the method might be made practically perfect. Mr. Jordan, with his usual ability, had given a drawing of the indicator, and had contributed largely to its mechanical advancement. Professor Moseley proposed to call this instrument the *pit work* counter, because it indicates, by comparison with the counter in present use, the amount of the pit work. Mr. Harris concluded by observing that this was a brief abstract of the very valuable paper furnished by Professor Moseley, and he was only sorry that the time allowed him had not permitted him to do Professor Moseley more justice than he had on the present occasion.

Steam Apparatus.—There is in the Oxford Union workhouse a steam apparatus by means of which the whole of the clothing and other articles used in it are washed, dried, and ironed, in an incredibly short space of time. We have lately been afforded an opportunity of witnessing this useful piece of mechanism in operation, on which occasion no less than 1235 articles of wearing apparel, bed-clothing, &c., were washed, dried, and ironed, in two days, with the assistance of only eight women and two girls from the school. It is the invention of James Wapshare, Esq., of Bath, for which we understand he has obtained a patent, and was some time since erected in one of the wings of the building solely devoted to the purposes of a laundry, at the expense of the chairman of the Board, the Rev. N. Dodson. The apparatus consists of a small steam boiler, with two pipes for the conveyance of steam. By the one pipe the steam is conducted to the coppers used for boiling the clothes and supplying the washers with hot water, by the other the steam is carried to a closet in which the linen is to be dried. The exterior of this closet is a wooden frame covered with zinc, within it is fitted up with pipes, increasing in number according to the extent of drying power required. These pipes are arranged horizontally one above another, resembling a turnpike gate; excepting that the rails are connected at one end only by a bend or turn, thus forming a continued duct for the steam. The steam is admitted at the upper pipe, and passes its condensed water at the lowest. On either side of this tier of pipes is a movable clothes horse, which is drawn out to be hung with clothes. Upon the construction of these horses the operation of drying in a great measure depends. They are made close at the top of the box, so that no heat may escape over them, and the clothes are so disposed on them as to form an entire sheet, completely enclosing the pipes, and preventing any escape of the heat radiating from the pipes, except by passing through the clothes to be dried. This disposition of the clothes is easily accomplished, but difficult of description. On the outside of the horses, or on that side which is not next the pipes, a valve or opening is made on the top of the box, and a current of air being admitted at the bottom, the steam from the clothes is carried off as fast as it is generated. One set of these pipes, with two horses, would be sufficient for any moderate family. In an establishment so extensive as an Union house more is required. In the closet erected are three ranges of pipes, and consequently six horses or two to each range, having an air space, with its valve between each set of horses. Attached to the flue that surrounds the boiler is a small oven for heating the irons, so that the whole operation of the laundry, as far as heat is required, is simultaneously effected by one fire.—*Oxford Herald.* [We insert this notice, not for its novelty, but for its utility, and to show the application of steam to domestic purposes, in the erection of extensive buildings intended to contain a large number of inmates. We cannot, from the above description, ascertain what claim Mr. Wapshare can have for a patent, as similar arrangements have been adopted many years past.—Ed. C. E. & A. Jour.]

Harbour Crane.—A crane capable of raising great weights at the harbour having been found indispensable, a considerable time since, Mr. Leslie, engineer to the harbour, executed a plan for a machine capable of raising thirty tons. The merit of the design has been very extensively acknowledged among professional men, and those who are initiated in mechanics. Mr. Peter Borrie, the contractor for the work, has been engaged for some time past in casting the different parts of the crane. The novelty of the design, and the magnitude of the work, evince the skill and attention which must have been bestowed upon its completion. The gross weight of the post, including the back and side tension-bars, friction collar, hoops, &c., is no less than twenty-five tons, or within ten tons of the weight which it is intended to lift. The pedestal for this crane is a beautiful piece of masonry; and rising considerably above the quay, it was necessary to raise the post to an elevation of fifty-five feet before it could be put into its place. This was done by two tackles and crab windlasses of great power—the upper blocks being fastened, at a height of sixty feet, to the apex of three shear poles. The whole time occupied in the transit of the axle pole, and in raising and lowering it into the cast-iron cylinders, did not exceed six consecutive hours. Ten men were found adequate to perform the whole operation of raising and lowering the post, and adjusting it to its proper position in the cast-iron cylinder. The extreme length of the post over all is nearly forty-five feet. As the crane is not yet completed, we cannot speak of it as a whole; but there cannot be a doubt that it will be a great advantage to the large class of steamers, especially to our yet unrivalled London steamers. And we understand that as soon as it is ready, and disengaged (for the steamer Perth has secured the first turn), a very large steamer from a distance is to be brought to Dundee in order to get in new boilers. In this way, we have no doubt, an ample recompense will be obtained for the great accommodation now to be given for the shipping at the port. Much work, anda considerable amount of shore-dues, may, in consequence of the facilities afforded by the crane, be brought to Dundee, which otherwise would have been lost to it. The testing of this vast machine will be a process of some interest; and we have no doubt the successful result will add to the well earned reputation of Mr. Leslie; and be highly creditable to Mr. Borrie, by whom the work has been executed.—*Dundee Courier.*

Seguin's Animal Gas Apparatus.—In a memoir on the compression of gases, and on the reduction of variable pressures into regular pressure, M. Seguin gives the Academy of Sciences a description of a new pump, with a regulating apparatus, for the compression of gas for illumination obtained from the distillation of animal substances. The pump is so arranged as to give the maximum force at the moment of the course when the gas presents the maximum of resistance by the diminution of its volume; to work in a vertical position without loss of gas, and without the piston being immersed in fluid; and lastly to avoid, by means of a particular mode of transmitting power, the use of guides, which would cause a friction in the piston-rod.

Artesian Wells.—M. Viollet has communicated to the Academy of Sciences the results of the experiments which he has made at Tours, to ascertain the quantity of water supplied by an Artesian well, after some repairs undertaken for the purpose of remedying a considerable diminution which took place in the produce. The repairs executed under the direction of M. Mullot had complete success, and the well now serves to supply motive power for the silk mill of M. Champoiseau. The well, which in July, 1834, immediately after its completion, only supplied 1600 litres per minute to the surface, has since given the following results ascertained by gauging kept up from the 15th to the 23rd of May last.

0·50 metres above the surface	3480 litres per minute.
4·75 . . .	1620
5·75 . . .	1140

The well having been put into action, and supplying its water from the 23rd of May from a new orifice, situated 5 metres above the surface, I found by gauging, on the 2nd of August, a produce of 1702 litres per minute, instead of the 1620 only, which the orifice at 4·75 metres gave in the 23rd of May. The produce has, since then, still further increased, which progressive increase is attributed by M. Viollet to the alimentary channels being cleared by the rejection of the sand brought to the surface by the water of the well; but it is important, as it leads to the hope that the unfortunate diminution of supply will not again occur. [We cannot entertain the confidence of M. Viollet, but must feel, to some extent, distrustful of wells sunk in sandy strata, which are exposed to many inconveniences.—Ed. C. E. & A. Jour.]

REVIEWS.

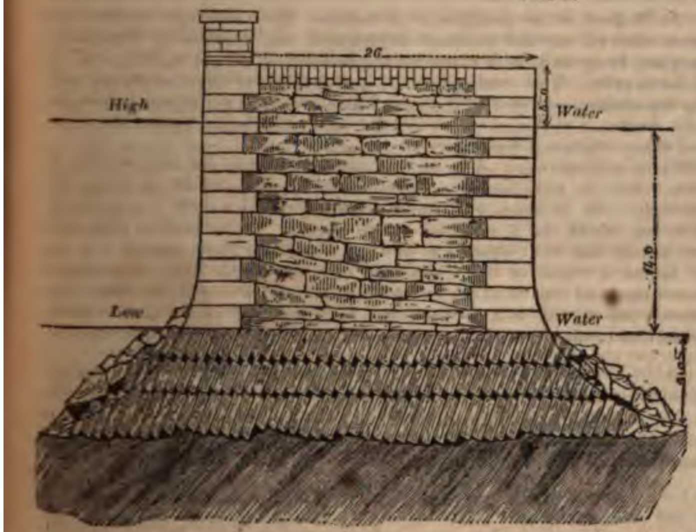
Theory, Practice and Architecture of Bridges. The theory by JAMES HANN, *of King's College, and the practical and architectural treatises by* WILLIAM HOSKING, F.S.A., &c., Vol. I. London: John Weale.

OUR present remarks will be confined to Mr. Hughes's paper on the "Foundations of Bridges," as we have previously noticed most of the other articles. Mr. Hughes commences his paper by taking a review of various methods of laying foundations by mean of caissons, next he explains the manner of building bridges on dry land, the stream being afterwards diverted from its old course and made to pass under the new bridge,—he then explains the method of building piers called by the French *encaissement*, practised by Belidor. Afterwards comes the method of laying, in deep water, foundations of piers, bridges, &c., without the aid of a coffer dam. As this portion of the paper will best explain the talents and capacity of its author, we shall give a lengthened extract, accompanied by the wood engravings, liberally furnished to us by the publisher.

THE first work of the kind I shall describe was projected by Mr. Telford, and executed under the superintendence of Mr. David Henry, at Ardrossan Harbour, in Ayrshire, N. B.; and as the mass of stones used in the foundation was there set in tolerably regular order under water, without the aid of coffer-dam, or caisson of any kind, there can be no doubt of the same system being equally practicable in many cases of bridge foundations.

The stones at Ardrossan were of very large superficial dimensions, varying from six to ten feet long, and three to five feet wide; they were first held fast by an implement, technically called nippers or devil's claws, and were then lowered by a crane through a depth of six or eight feet of water on to a hard and solid foundation. The blocks were placed end to end, the position of the last stone lowered being found by probing with a slight iron rod; and as soon as each stone was in its place longitudinally, the claws were disengaged, and the stone allowed to rest upon the course below, as seen in fig. 1. The courses were continued entirely through the whole thickness of the pier; and when a sufficient number had been laid to bring the work up to the height of low water spring tides, the whole beeadth was levelled, and all the unequal projections chipped off, in order to prepare a bed for the firs course of dressed masonry. The work then proceeded in the regular manner, consisting of alternate headers and stretchers of properly squared ashlar in front, with dry stone hearting of squared scapple dressed rubble inside, and in this way was carried up to the full height required.

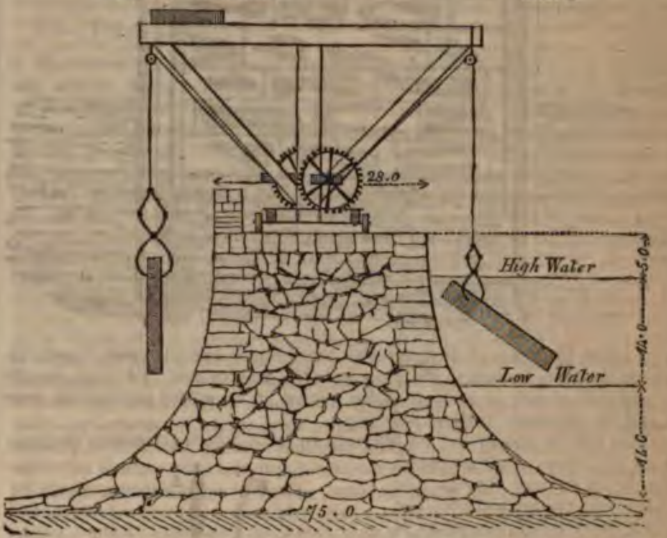
FIG. 1.



When the writer visited this work, in the year 1818, it had been advanced a considerable distance into the sea; and although parts of it had been exposed to some very heavy storms, neither flaw nor settlement could be discovered in any part of this excellent piece of dry-built masonry.

From an account of some foundations similar to that described above in the recently published life of Mr. Telford, it may be seen that the practice has been much more extensively adopted, and a far bolder attempt carried out by Mr. Gibb, of Aberdeen, than the one acted upon in the other work at Ardrossan. The pier at Aberdeen is extended into the sea, with a breadth at the base of seventy-five feet, the bottom consisting entirely of irregularly shaped masses of stone, which having been conveyed to the spot in boats, were tumbled in by chance to the depth of ten or twelve feet. In the drawings composing the Atlas, which accompanies the life of Mr Telford, the low water mark is shown about fourteen feet above the bottom, and in the narrative of this work by Mr. Gibb, he states, that the bottom under the foundation is nothing better than loose sand and gravel, and that the front ashlar commences at about one foot under low water mark, and is carried up to the top of the pier, which the drawing shows to be about thirty-three feet in height from the bottom to the top. The rise of the tide is shown to be fourteen feet, the breadth of the pier twenty-eight feet, the sides carried up with a slope inwards. Fig. 2, describes the method adopted by Mr. Gibb.

PIER AT ABERDEEN. FIG. 2.



The author next proceeds to describe an economical method of building the foundations of a pier as practised by Mr. Telford at Inverness, to avoid the expence of erecting a coffer dam. This is well deserving of notice on account of its simplicity, particularly the part explaining the "lewis."

At the site fixed upon for the intended pier, the depth of water, at the lowest spring tides, was never less than four feet, and at ordinary low water five or six feet; the bottom a very hard gravel, united with clay. The whole length of the breast work was about one hundred and sixty feet, and throughout this distance the bottom was dredged out, to the width of eight feet, and depth of two feet, to receive the masonry.

A simple system of piling was however driven previous to founding the masonry. The piling consisted of two bearing piles, twelve feet long, and eight inches diameter, driven down at intervals of twenty feet; and across the heads of these piles, and level with low water mark, cross pieces of elm planking twelve feet long three inches thick, and one foot wide, were fastened with trenails. On the top of these were laid longitudinal half timbers, one foot wide, and six inches deep, secured to the cross pieces and bearing piles by rag bolts, driven into each pile head.

The accompanying sketches, figs. 3 and 4, will amply illustrate the forms and disposition of the timber work in the foundation. In addition to the bearing piles, a row of timber slabs, of inferior quality, was also driven down a few inches into the bottom, at intervals of about ten or twelve inches; these had a spike driven through them, near their heads, and into the longitudinal logs of half timbers; there were merely to answer the purpose of guide timbers, to set the stones by, and to determine the guage or breadth of the work, and were afterwards removed.

The bottom on which the pier was to be founded being now made as level

FIG. 3.

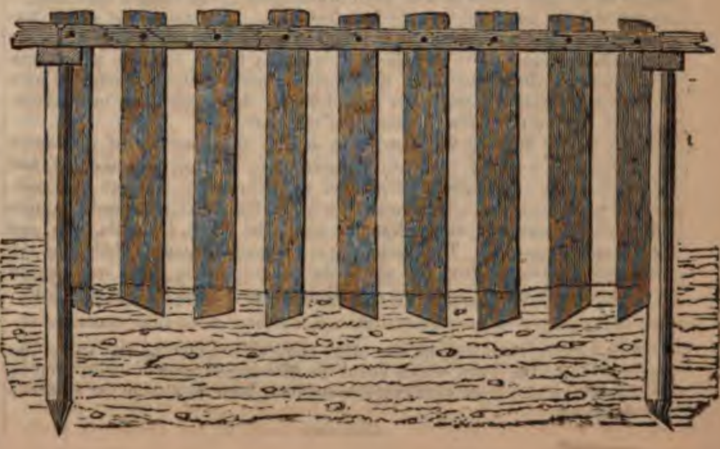
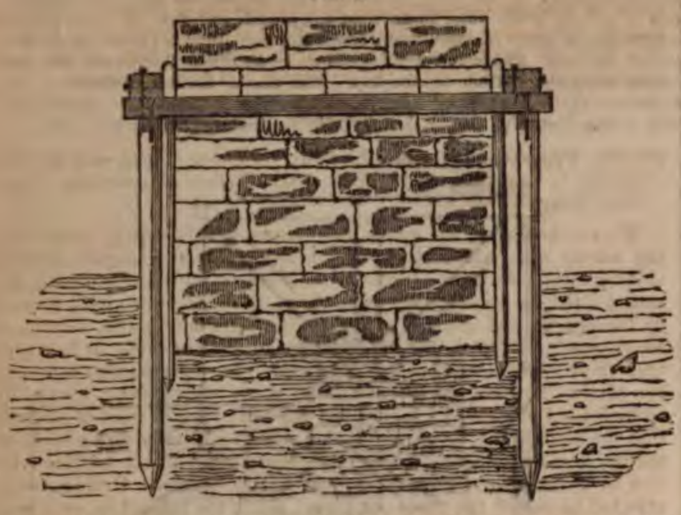


FIG. 4.



a• possible by means of dredging with the common bag and spoon apparatus, the stones were brough to the place in boats, and lowered by a crane, in such a way that as soon as each stone was placed in its proper position the *lewis* could be withdrawn without difficulty.

This will be understood on referring to fig. 5, which represents the lewis fixed in a stone, ready prepared for being lowered through the water into the foundation. The lewis consisted of two pieces of iron B and D, and in order to use it a part of the stone must be cut out, sufficiently wide at top to receive the base of the part B, the base of the opening of the stone being equal to the united width of D and B; A is the chain suspended from the arm of the crane,* and E a small rope or string, of which the end is kept above water, to pull out the rectangular part D of the lewis.

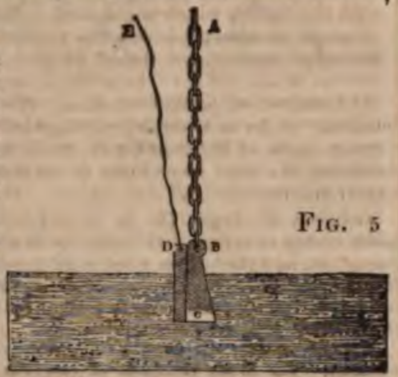


FIG. 5

It is easy to see the method of using this instrument: the piece B is first inserted, and D is then put in to secure it, when it is evident that the heavier the stone may be, provided it be strong enough, the more securely will it be held by the lewis when suspended from the crane. Conceive the stone now to have been lowered through the water, and carefully laid in its proper place in the foundation; the chain from the barrel of the crane is then loosened, and the part B of the lewis being slightly knocked with an iron rod from above, is easily made to drop down into the vacant space C. It is evident that the fastening piece D will then be loose, because between this and B there is a space left equal to the difference between the base of B, and the base of the opening in the stone. D may therefore be drawn out by means of the string E, and B will readily follow on pulling the chain A, and the lewis is again ready to be inserted in another stone.

All the front stones of the foundation were laid with a lewis of this kind, as well as the backing of squared stones, which were previously scapple-dressed at the quarry. The whole of the stones in any one course, for the length of the pier, were laid of equal thicknesses; they ranged from four to seven feet long, and from three to four feet wide. As soon as one course was complete another was laid, and the length of each stone being marked on the longitudinal beams above the piling, it was easy to set them so as to break bond, and the whole process of thus building under water was effected with the utmost regularity, and with less difficulty than could have been anticipated by the most sanguine advocates of the plan.

When all the building was carried up as high as the surface of the lowest water mark of a spring tide, any irregularity on the top was taken off, and the whole surface carefully levelled, and on it the ashlar masonry was commenced and carried up with a vertical batter. This work consisted of stones with picked fronts and chisel-draughts round the edges, the ends, beds, and face, properly squared. The backing was of good common rubble, and the whole being raised to three feet above the highest spring tides, was finished off with a heavy coping, properly dowelled, cramped, and secured with lead.

This work, from its situation, is called the Thorn Bush Pier; the date of its construction was 1815, and up to the present time no appearance of failure or imperfection has been observed.

Mr. Hughes then reverts to the consideration of coffer dams, and points out as good examples the coffer dams of the new Houses of Parliament, and the one constructed at St. Katharine's Dock, both of which, we are happy to say, have been described in the first and second volumes of our journal, accompanied by the specifications. We consider the latter ought at all times, if possible, to accompany the drawings, as they at once convey to the profession the minutiæ of the construction, and of the materials used. As we have so fully explained to our readers the construction of the above works, we shall not avail ourselves of any extracts from the able comments of the author in the paper now before us, but shall proceed at once to the other portion explaining the advantages of building inverted arches. The author recommends, where the bottom is unsound, to cover it entirely over with cross sleepers of Memel logs, and on them to lay a covering of planks closely jointed. In support of this method of construction he cites an example of the late Mr. Rennie, who introduced it for the foundation at the Albion Mills, close to Blackfriar's Bridge. We cannot give our consent to this mode of building, being decidedly averse to the introduction of planking and piling, excepting for hydraulic works when both are constantly under water; we would at all times risk a good bed of concrete over the whole surface as adopted at the Westminster Bridewell, or a broad foundation as adopted by Sir Robert Smirke at the Penitentiary, the latter example is alluded to by the author in a subsequent part of the paper. The marshy nature of the land on which both those buildings were erected, and their present appearance in point of stability clearly show that concrete may be used with safety in almost, if not all situations: we have seen such ill effects of planking for foundations of land buildings, that we dread the very name of it, not only is it liable to rot, but also to be crushed. We should think that the timber forming the bottom of the caisson upon which the piers of Westminster Bridge stand has been crushed full an inch in thickness; here it was of no consequence, as the timber was always under water, and remains to this day sound as on the day when laid down, but there are situations in which the crushing of an inch in thickness may be partial and cause considerable settlements in the building, particularly if there be many openings with arches in the superstructure. The following observations relative to Mr. Telford are well deserving the attention of the junior members of the profession.

> Mr. Telford in his practice as an engineer was exceedingly cautious, and never allowed any but his most experienced and confidential assistants to have any thing to do with exploring the foundations of any buildings he was about to erect. This scrutiny into the qualifications of those employed about the foundations extended to the subordinate overseers, and even to the workmen, insomuch that men whose general habits had before passed unnoticed, and whose characters had never been inquired into, did not escape Mr. Telford's observations when set to work in operations connected with the foundations. He was accustomed to examine men so employed whom he thought unsteady, and, if necessary, would reprimand the overseers for employing such men about the foundations in any capacity. It is evident from these precautions that Mr. Telford was well convinced how dangerous it was even to receive a report of the strata from men of careless habits or inefficient knowledge, and that he also knew the consequences which might follow from careless pile-driving, and, in short, from the absence of proper care in all the operations connected with the commencement of an important structure.

In the third division of this paper the author makes some judicious remarks on foundations of sand. Mr. Hughes then proceeds to describe a very strong coffer dam for a river where there is a great depth of water, from this part of the paper containing some excellent instructions, we take the following extract relative to "puddle."

> Considering only the two extremes of very hard and very soft plastic clay, it will be found that the former of these, when broken up and thrown in between the piles, will seldom or never form a perfect dam. On the contrary, vacuities will remain between the broken pieces, and it will be found exceedingly difficult to beat down clay of this kind into a body sufficiently firm, compact, and solid to resist the efforts of the water to penetrate through it. If, again, clay of a very soft plastic nature be introduced, it will partially dissolve and combine with the water when thrown into it, so that the space between the piles will be filled with a kind of mud puddle almost in a fluid state, of no greater consistency and no greater capability of keeping out water than mud itself. It is evident therefore that either kind of clay by itself would not answer the purpose intended of forming a solid water-tight puddle. All the clays, when used in a coffer-dam, require a mixture of gravel and sand, or a portion of pounded chalk will be found an excellent material to give solidity to the soft portion of the clay, and to fill the vacuities and interstices which may be expected to exist where the clay is of a hard and lumpy description. However general may be the opinion, it is certain that one more erroneous was never entertained than that clay alone is a proper

---

* It is quite evident that by any other mode of suspending the stones excepting that of the lewis, which could be disengaged under water, even an approximation to a close joint could never have been effected in the situation now described.

material to make a good puddle-dam. Clay by itself is subject to great changes, according to the alternations of heat and cold, drought and moisture. In very dry weather, and when exposed for a time to the influence of the sun, all moisture will be extracted; and the clay will invariably crack and separate into a number of irregular fragments, which will never afterwards unite so as to form an adhesive water-tight substance. The difficulty of compressing clay, when placed in a dam of any considerable depth, into a solid mass without hollows has been already noticed. If in addition to this objection we consider the immense weight and pressure of clay so compressed against the piles forming the sides of the dam, and the consequent strain on the piles, which ought only to be employed in resisting the pressure of the water from without, we shall see sufficient reason to decide, on these as well as on other grounds, against the practice of puddling entirely with clay. From the very best information which can be brought to bear on this subject, namely, that derived from long and watchful experience, accompanied by the knowledge that he has himself, as a contractor, lost large sums of money on account of too great a faith in clay puddles, the writer is enabled to speak very positively on the nature of this material, and in addition to the objections already advanced begs to add his own personal observations of the fact that puddles composed entirely of clay have usually bulged, given way, and been found incapable of keeping out the water when of considerable depth, and that in any case a puddle with an admixture of gravel, chalk, and sand will make a safer water-tight dam than clay alone.

The fourth division treats on the value of concrete as a substitute for stone or timber in foundations, and describes the various qualities of lime and sand, and their proportions in which they ought to be used. The author has given some remarks on the defective construction of part of Gloucester Bridge, from the settlement of the wing wall on the Gloucester side which is fractured from its base to the top of the parapet, where, he states, there is an opening nearly three inches wide. We rather suspect that some other settlements have escaped the eye of Mr. Hughes, when we were at Gloucester about two years since, we observed some fractures over the arch which had been stopped up with cement, and instead of the wing walls only having gone down, we consider that the abutment on the Gloucester side has also gone down, or is forced a trifle from its perpendicular position in consequence of the giving way of the wing walls, and has caused the settlements we have named.

Mr. Hughes next explains the causes of settlements in the wing and abutment walls of bridges by using for the backing a puddle of clay; he observes, that the cracks and fissures which attend the drying of clay, when much exposed, are so exceedingly dangerous, as affording lodgement for water to press against the wall, that there is every reason to expect, at some time or other, fractures and dangerous settlements in walls which have been thus backed. We have heard of several instances of bridges constructed on railways, where the abutments and wing walls have been forced out of their places, although built with a considerable batter, to nearly perpendicular, owing to the backing of clay having swelled through additional moisture. Where it is requisite to build retaining walls in clay cuttings, it is necessary if the strata have any dip to build the upper retaining wall thicker than the lower one, and also to give the slopes of cuttings on the upper side a greater declivity than the lower one, as the clay is naturally inclined to slip on its bed.

In the concluding portion of the paper Mr. Hughes has made some very able comments on the principal clauses of a contract deed which the contractor is required to sign; but as we have already so copiously extracted from the paper, we must, in justice to the publisher, resist intruding any farther. With his remarks on the various clauses we fully concur, and we trust that it will not be long before a more equitable spirit breathes through the conditions of a contract. We feel convinced that it is the only way to obtain opulent and respectable contractors to undertake large works, the present stringent clauses throwing the whole onus of the construction on the contractor, and removing all responsibility from the engineer, is a premium for ignorant pretenders to enter the profession, many of whom, probably, have obtained a fine theoretical education, and are able to make very pretty drawings, which they fancy entitle them to the initials C. E. at the end of their names, but which are very far from assuring a sound knowledge of construction.

Before we close our remarks we must allude to the "getting up of the work," the first volume contains 110 engravings beautifully executed, and possessing considerable merit in point of construction, and as examples of bridge building. The letterpress contains 5 papers, No. I. Theory of Bridges, by Mr. Hann; II. Translations from Gauthey; III. Theoretical and Practical papers, by Professor Moseley; IV. A series of papers on the Foundations of Bridges, by Mr. T. Hughes; V. Account of Hutcheson Bridge at Glasgow, by Lawrence Hill, Esq., and the Specification by Mr. Robert Stevenson, of Edinburgh. Most of these papers, as they appeared in numbers, we had occasion to speak of with the highest praise, and we feel much pleasure in finding that the concluding part of the first volume is quite equal to the former. We have no hesitation in saying that it will be one of the most valuable publications which the profession can wish to possess.

Heath's Picturesque Annual for 1840: *Windsor Castle and its Environs*, by Leitch Ritchie, Esq., *with Fifteen Engravings*. London: Longman and Co.

We recommended the preceding volume of this annual, as containing among other illustrations of Versailles, several highly finished architectural interiors,—a class of subjects all the more welcome, because, although exceedingly interesting, they are very rarely treated by the pencil; and the two views of the kind here given, namely, of St. George's Hall and the Waterloo Gallery, only cause us to regret that there should be none of any of the other apartments; not even one of the corridor, or any portion of it, to convey some idea of its architectural character. It certainly was not owing to want of subjects that the choir of St. George's Chapel—the architecture of which, by the by, is sadly disfigured by the barbarous design of the pointed window over the altar, which looks just like Carpenter's Gothic;—was selected as one of the three interiors; while the subject is very well known, having been given in Pyne's Royal Residences, and other publications. We certainly would very gladly have exchanged it for something else. We pass over the other engravings, because although many are executed with great spirit and ability, they are chiefly of scenery in different parts of the Park, and are connected only *remotely* with the Castle, which is removed farther off than we could wish. Yet although architectural subjects generally may not be so popular as landscape scenery, we should imagine that like ourselves, most other persons would not have been displeased had there been a majority of the former class, on this occasion. We should have been grateful too, had the editor in some degree supplied this deficiency by treating at great length of Windsor Castle as it really is at the present day, and entered into some more exact description of the principal apartments, their architecture and decorations. However, as description of that kind does not appear to be by any means the editor's forte, there is less reason to regret that he has been so exceedingly sparing of it. It appears, however, from what is here said that we are likely to obtain a full architectural account of Windsor, it being stated—upon sufficient authority, we presume, that Sir Jeffery Wyattville himself is now preparing a series of drawings and other materials for the purpose.

The view of the Ruins at Virginia Water after a drawing by Harding, is one of the most attractive of the landscape subjects, quite a poetical scene in itself—and one of which we have never before met within any representation; and though the same cannot be said of the view of the Fishing Temple and Lake, that is a very charming composition by the same tasteful artist, and admirably engraved. Most undoubtedly we should have been better gratified had the illustrations been confined entirely to the Castle itself, and to the newer portions of the edifice; but we must also admit that the proprietor had to consult the taste of the purchasers of Annuals. We hope, however, that he will yet bring out some graphic publication expressly devoted to that class of subjects—namely, architectural interiors, of which Versailles and Windsor have furnished some specimens.

Memoir of a Mechanic, being a Sketch of the Life of Timothy Claxton, written by himself, together with Miscellaneous Papers. Boston, United States; G. W. Light, 1839.

This, although published at the same time by a different author, is a kind of American version of the Hints to Mechanics, by Mr. Claxton, but although derived from nearly the same sources, is not quite so interesting. Boston, like Edinburgh, has dubbed itself an Athens, has the same mania for lionizing, and the same want of philosophers for their academic groves. In this emergency they have laid hold of Mr. Claxton, and although they might find a more majestic lien, a more useful one they will not easily discover, Like the works of Franklin, it is a plain, practical manual of advice to the working classes, which instructs in the best way, that of example.

It says much for the literary appetite of Boston that they can devour such a work, and it says still more for them that, knowing how thin-skinned their countrymen generally are, that they should have allowed Mr. Claxton to give free vent to some of his old country prejudices, which we know go so greatly against the grain.

Companion to the Almanac for 1840. London: Knight & Co.

As usual this publication contains a great deal of highly interesting architectural matter, in the way both of descriptions of, and comments upon, new buildings and other improvements, illustrated with several clever wood engravings. Of these latter the subjects are, Mr. Wild's two churches at Blackheath and Southampton, the new church Park Street, Bankside, the Club-house Chambers, Regent Street, and plans, &c. of Mr. Cockerell's new buildings at Cambridge for the Public Libraries, &c. Among those buildings which, although not accompanied with any cuts, come in for a large share of notice and remarks are, Mr. Barry's Reform Club, and Mr. Tattersall's chapel at Dukinfield, as does likewise the new building in Wellington Street, for Bielefeld's Papier Maché Works.

The comments on the plan of the Cambridge Libraries are pertinent,—though, perhaps, the architect may be disposed to prefix an *im* to that epithet—and judicious; for it certainly does appear that the building will be more irregular than even the awkwardness of the site requires; nor that only externally but internally too, because many of the principal apartments will be thrown quite out of square, one of them sloping off instead of being parallel to the opposite one. It is therefore to be hoped that that part of the plan will be reconsidered before it shall be actually began.

We shall quote only two of the minor paragraphs:

Keswick Church, lately erected by Mr. Salvin, is a stone edifice in the early pointed style, of about the time of Henry II, with a tower, surmounted by a low spire, and a small octagonal building, attached to the south side of the church, for a vestry room. This latter is covered by a very steep, or spire-shaped roof, and forms a very striking feature in the design, to which it imparts a great degree of picturesque variety. This church was commenced by the late John Marshall, Jun., Esq., and has been completed by his widow. It is not capable of containing more than 412 persons, viz., 48 in pews and 364 in free seats. Cost, £6,280.

Darlington Church, another work by the same architect, is very different in design, being a long and low but high-roofed structure, of rather primitive character, with small and plain pointed windows, at irregular intervals, and a square tower (in which is a porch) on the north side. It was built by subscriptions and donations for the sum of £3,254; yet, although the cost is little more than half that of the preceding building, it is capable of accommodating more than double the number of persons, viz., 1,010; 410 in pews and 600 in free sittings."

In a previous part of the volume is a section upon "Railways," containing much statistical information on that subject.

Manchester as it is, with numerous Steel Engravings and a Map. Manchester: Love and Barton.

THIS is a very useful and interesting little work, descriptive of all the public buildings, institutions, exhibitions, canals, warehouses and manufactories, in short it appears to contain all the information that a visitor may wish for as a guide to Manchester. We select the following extracts to show the nature of the work.

STEAM ENGINE MAKING, AND ENGINEERING.

ONE of the principal establishments in Manchester, in these departments, is that belonging to William Fairbairn, Esq., situate in Canal-street, Great Ancoats-street. To persons unacquainted with the nature of working in iron, an admission into these works affords, perhaps the most gratifying spectacle which the town can present of its manufactures in this metal. Consequently, almost every person of distinction visiting the town contrives to procure an introduction to the proprietor before leaving it. In this establishment the *heaviest* description of machinery is manufactured, including steam engines, water wheels, locomotive engines, and mill geering. There are from 550 to 600 hands employed in the various departments; and a walk through the extensive premises, in which this great number of men are busily at work, affords a specimen of industry, and an example of practical science, which can scarcely be surpassed. In every direction of the works the utmost *system* prevails, and each mechanic appears to have his peculiar description of work assigned, with the utmost economical subdivision of labour. All is activity, yet without confusion. Smiths, strikers, moulders, millwrights, mechanics, boiler makers, pattern makers, appear to attend to their respective employments with as much regularity as the working of the machinery they assist to construct.

In one department mechanics are employed in building those mighty machines which have augmented so immensely the manufacturing interests of Great Britain, namely, steam engines. All sizes and dimensions are frequently under hand, from the diminutive size of 8 horses power, to the enormous magnitude of 400 horses' power. One of this latter size contains the vast amount of 200 tons or upwards of metal, and is worth, in round numbers, from £5,000 to £6,000.

The process of casting metal is conducted here on a very large scale. Castings of twelve tons weight are by no means uncommon: the beam of a 300 horses' power steam engine weighs that amount. Fly-wheels for engines, and water-wheels, though not cast entire, are immense specimens of heavy castings. A fly-wheel, for an engine of 100 horses' power, measures in diameter twenty-six feet, and weighs about thirty-five tons. In this establishment some of the largest water-wheels ever manufactured, and the heaviest mill-geering have been constructed; one water-wheel, for instance, measuring sixty-two feet in diameter. The average weekly consumption of metal in these works in the process of manufacturing, owing to the quantity of wrought iron used, and the immense bulk of the castings, is 60 tons or upwards, or 3,120 tons annually.

The preparation of patterns,—wood fac-similes of the castings,—is a very costly process. Every piece of machinery, before it can be cast, must be constructed in wood; and these *patterns,* as they are termed, are made to form, in sand, the mould into which the liquid ore is poured. Fifty men are daily employed in making patterns, The patterns, which are part of the proprietor's *stock in trade,* are worth many thousand pounds. After being used, the most important are painted and varnished, and laid carefully aside, in a dry room, to be ready for use when machines may accidentally get broken, or to aid in the construction of new ones. The patterns are made frequently of mahogany.

A most curious machine is employed for the purpose of *planing iron;* and, by means of its aid, iron shavings are stripped off a solid mass of metal, with, apparently, as much ease as if it were wood, and with the greatest regularity and exactness. Not the least interesting department of these works is that appropriated to boiler making. Boilers, for steam engines, are composed of a number of plates of wrought-iron, about $\frac{3}{8}$ of an inch in thickness. They are riveted together, with rivets about $\frac{3}{4}$ of an inch diameter, holes to receive which are punched through the plates, by a powerful, yet simple, machine, with as much facility as if the resistance was mere air. The process of riveting was, on the *old method,* an extremely noisy one; but a new plan, is adopted here, and by it the work is performed silently, and much more efficiently. Some time ago about 50 boiler makers were employed by Mr. Fairbairn. The "struck," as it is termed, because their employer infringed, as they considered, upon their privileges, by introducing a few labourers, not in "The Union," to perform the drudgery connected with the work. On this occurring, Mr. Fairbairn and Mr. Robert Smith invented a machine which superseded the labour of 45 out of the 50 of his boiler makers. The work is performed by the machine much quicker, more systematically, and, as before said, without noise.

LOCOMOTIVE ENGINE AND TOOL-MAKERS.

Under this head may be classed several extensive works, in and about Manchester.* One of the largest is that possessed by Messrs. Nasmyths, Gaskell & Co., situated at Patricroft, four and a half miles distant from Manchester, and immediately adjoining the Liverpool and Manchester Railroad, at that part where it crosses the Bridgewater Canal, which great national work forms the boundary or frontage of the ground on which the above establishment is erected, and which, in consequence, has been named, "The Bridgewater Foundry."

These works have a frontage to the railroad, as well as to the canal, to the extent of 1,050 feet; which circumstance supplies every possible facility for communication, either by land or by water carriage. One of the "stopping stations" of all the second class trains being opposite, persons desirous of visiting these works, can be set down at the entrance gate. The distance in *time,* from Manchester, is only from ten to fifteen minutes.

The above establishment is of very recent erection, having been in existence only about two and a half years. There are employed at present about 300 men: the greater part of whom, together with their families, live in cottages which the proprietors have erected for their accommodation. The situation of these works is not only most admirably adapted for the purposes for which they have been erected, but it also secures, in a great degree, good health to the men employed; for, being surrounded on all sides with green fields, and being, moreover, on the *west* side of Manchester, a very long lease of pure air is secured; a circumstance of no small importance, as regards the health and comfort of the workmen employed.

The whole of this establishment is divided into departments, over each of which a foreman, or a responsible person, is placed, whose duty is not only to see that the men under his superintendence produce good work, but also to endeavour to keep pace with the productive powers of all the other departments. The departments may be thus specified:—The drawing office, where the designs are made out; and the working drawings produced, from which the men are to receive the necessary information. Then come the pattern-makers, whose duty is to make the patterns, or models in wood, which are to be cast in iron or brass: next comes the foundry, and the iron and brass moulders; then the forgers or smiths. The chief part of the produce of these two last named pass on to the turners and planers, who, by means of most powerful and complete machinery, execute all such work on the various articles as require either of these operations; besides which, any holes that are required are at this stage bored, by a great variety of drilling machines, most of which are self-acting. Then come the fitters and filers, who, by means of chisels and files, execute all such work as requires manual labour, and perform such delicate adjustments as require the individual attention of the operative: in conjunction with this department is a class of men called erectors, that is, men who put together the frame-work, and larger parts of most machines, so that the two last departments, as it were, bring together and give the last touches to the objects produced by all the others. A machine having passed through these departments, is now ready for a coat of paint, which having received, it is taken to pieces (after all the parts are marked, so as to enable its being put together when it arrives at its destination), the bright parts are smeared with tallow, and, if required, placed in packing cases, which are then handed over to the foreman of the labourers, who, by means of the crane or railroad, place them in the canal boat or railway waggon.

---

* Messrs. Sharp, Roberts, & Co.'s, Messrs. Peel, Williams, & Co.'s, are among the first in importance.

With a view to secure the greatest amount of convenience for the removal of heavy machinery from one department to another, the entire establishment had been laid out with this object in view; and in order to attain it, what may be called the straight line system has been adopted, that is, the various workshops are all in a line, and so placed, that the greater part of the work, as it passes from one end of the foundry to the other, receives, in succession, each operation which ought to follow the preceding one, so that little carrying backward and forward, or lifting up and down, is required. In the case of heavy parts of machinery, this arrangement is found exceedingly useful. By means of a railroad, laid through, as well as all round the shops,* any casting, however ponderous or massy, may be removed with the greatest care, rapidity, and security. Thus nearly all risk of those frightful accidents, which sometimes occur to the men, is removed. The railroad system is now beginning to be as much attended to, and its advantages felt in concerns of this nature, as it is in the transit of goods and passengers.

Nearly one uniform width is preserved throughout all the workshops of this extensive concern, namely, 70 feet; and the height of each is twenty-one feet to the beam. The total length of shops on the ground floor, already built, amounts, in one line, to nearly 400 feet. There are, besides, four flats of the front building, each twelve feet high, 100 feet long, and 60 feet wide. Into these rooms a perfect flood of light is admitted by very large windows on the side walls, as well as through sky-lights in the roof.

The Foundry occupies one portion of this building, namely, 130 feet by 70 feet, in which great apartment or hall there is not a single dark corner: a point of vast importance where the operations are conducted with a black material, namely, the moulding sand. The iron is melted in one or more of four cupolas, according to the weight of the casting. The cupolas vary from three to six feet in diameter, and when all are in active operation, melt thirty-six tons of iron. The great cauldron, or pot, in which the metal is contained, is placed, during its transit from the furnace, on a carriage, which moves along a railroad in front of the four cupolas; and thus any portion of melted metal can be received and conveyed, with the most surprising rapidity and ease, to any point of the surface of this great hall. These great pots contain, at times, each six or seven tons of melted iron, and, by means of a crane, whose arms sweep every part of the foundry, are handed from place to place as if wholly devoid of weight. The crane posts are two great cast-iron columns, around which the crane arm swings. The columns serve at the same time as supports to the roof, and by proper ties, the strain of such great weights is diffused over the whole building, and each brick made to share the load. The *blast* of air for the furnaces is supplied by a fanner, five feet in diameter, made to revolve at the rate of 1,000 revolutions per minute, the air or blast being conveyed under ground in a brick tunnel, from which it is distributed to each furnace by sheet-iron pipes, varying from three to nine inches, according to the size of the furnace at work at the time.

There are at present fifty-six turning lathes, of all sizes, at work in this establishment. several of which are what is called self-acting,†—that is, the work has only to be placed in the lathe, and the tool set, and the machine does the remainder of the work with unerring accuracy and ease.

Planing machines are extensively used here. The immense power of one of these machines may be imagined, when it is considered that the amount of resistance against the edge of the knife which planes the iron is, in a large machine, as much as thirty tons. This fact leads to the consideration of the hardness of the instrument which has to encounter, for perhaps a day together without becoming inoperative, this immense resistance. By means of this admirable machine every variety of geometrical figure can be produced with the most absolute accuracy—such as the plane, the cylinder, the cone, and the sphere. And as all possible varieties of machinery consist merely of these figures in combination, there is now every facility for producing whatever may be required.

Besides the manufacture of every description of engineers' tools, another branch of business for which this establishment has been erected, is that of locomotive engines, a branch of business which is rapidly acquiring great importance, and which will have few rivals as to magnitude. Lancashire appears to be completely taking the lead in this manufacture, which, from its very nature, can be carried on only on a large scale.

The room occupied by the steam, in a locomotive boiler, is ordinarily equivalent to ten cubic feet. Ten cubic feet of water will produce in steam, when expanded to the density of the atmosphere, as much as would occupy 18,000 feet of space. The steam is confined in the boiler by a pressure three times that of the atmosphere, so that, escaping from its confinement, it expands to three times the space it there occupied.

Architectura Domestica, von Alexis des Chateauneuf. Large 4 London: Ackermann and Co.

Recent circumstances have given this volume additional interest and recommendation, its author having obtained the second premium in the competition for the Royal Exchange, owing to which his name is no longer a stranger to English ears; and it may, perhaps, be worth while to remark that it had actually appeared prior to that event, consequently it was not the distinction he had so obtained which induced M. de Chateauneuf to bring it out in this country. Whatever may have been his motive for publishing it here, we hope he will have no reason to repent having done so, although we dare not flatter him by saying that he could not have selected a better market; because, if the truth may be spoken, there is far less encouragement given to works of this class here in England than on the Continent. However, we hope that M. de C. will find that there are exceptions to the rule, and that his own case is one of them. Still, one inconvenience we suspect has been occasioned by the work having been got up here, namely, that the author has in consequence been obliged to trust too much to others; and although as far as correctness and intelligence of form go, he could not, perhaps, have employed a more able engraver than Mr. T. T. Bury, we must say that delicacy of outline has been carried by him somewhat to excess. The breadth and depth, or rather the fineness of the lines, is so uniform as to produce a general faintness of effect; whereas, variety of line would have given not only greater vigour but distinctness, also to many of the plates. Mr. Bury would have done well to have looked at some of the architectural subjects in Penier's work on decoration; which, independently of their intrinsic interest, captivate the eye at the first glance, by the union of firmness and delicacy, which gives adequate relief to every object. This tameness in the execution of the plates certainly does not affect the designs themselves, otherwise than it exhibits them somewhat to disadvantage, and sometimes is attended with a degree of insipidity that may unluckily chance to be attributed to the subject, instead of the engraver's treatment of it. These remarks, we think, are called for, even in justice to M. de Chateauneuf, for there are one or two designs, which, had they been better expressed, would have been considered of more importance than they are now likely to be.

To come now to matter of the plates, we scruple not to say that although the designs display great inequality, on account of the very great difference of their subjects, some of the designs being for very small and unpretending buildings, while others afforded more than usual scope for invention—they give evidence of real talent and originality. Yet, being nearly all those of buildings executed for private individuals, the author has, in all probability, been more or less checked or thwarted, if not directly by his employers, by circumstances he was obliged to keep in view, and which prevented him from giving free scope to his own taste and imagination. What is most important is, that many excellent ideas and suggestions may be obtained from them. One of the happiest is that shown in plate 5—namely, a perspective interior of a Holstein barn converted into a garden or rustic saloon, and retaining just enough of the original character to show what has been the architect's motive. It might, perhaps, be pursued still farther, and thereby be found to lead to very much more; especially as regards the form of the ceiling, which might either throughout or in the centre compartment of such a room, be carried up higher than the walls, in two inclined planes, following the slope of the large truss brackets supporting the horizontal beams of the ceiling. The style is both well imagined and well kept up, and the whole is exceedingly pleasing, consistent, and harmonious, though obnoxious to objection from those who would indiscriminately proscribe every thing that is not supported by actual precedent, although indulgent enough towards all which is so authorized, no matter how bad it may be in itself. Granting the merit to be equal, or nearly so, in other respects, we should say that a design which brings forward some novelty is the better suited for publication; particularly in works of which the object either is or ought to be to bring forward fresh ideas, and such *motives* of plan or decoration as may be turned to account, by being adopted as a hint, without being either copied or even so treated as to lead at once to the source of it. This has not always been so well attended to as it ought to have been, else we should not meet with so many published designs as we now do, which afford no other instruction than what might just as well be obtained from almost anything else of the same kind. Such, we apprehend, will be found to be the case with the subject following the one we have just been speaking of; which consists of the plan and perspective view of a villa erected near Lubeck, for Dr. Buckholtz; but which we are by no means disposed to receive as earnest of what the author would be capable of producing, if at liberty to abandon himself freely to the impulses of his own taste. Most certainly will not bear comparison with that of an English house of the same size; the arrangement is undoubtedly simple enough, but too simple for either convenience or effect, and would, therefore, have, perhaps, been all the better, had some positive difficulty occurred, which it would have been necessary to combat.

---

* Abbreviation of "work-shops."

† "We may here with propriety say a word on the subject of self-acting tools, the more so because it is by means of these admirable adaptions of human skill and intelligence that we are giving to the present age its peculiar and wonderful characteristic, namely, the triumph of mind over matter.

"By whom or when the *slide* principle was first introduced we need not now enquire; suffice it to say that, by means of this principle, a most wonderful substitute has been found for the human hand in the fabrication of almost all parts of mechanism, whether the substance to be operated upon weighs tons or grains. The slide principle is that which enables a child, *or the machine itself*, to operate on masses of metal, and to cut shavings off iron, as if it was deprived of all hardness, and so mathematically correct that even Euclid himself might be the workman! It is by the slide principle that we are enabled to fix a steel cutter into an iron hand, and constrain or cause it to move or slide along the surface of a piece of metal in any required direction, and with the utmost precision. By means of this principle all the practical difficulties hitherto encountered in the extending and improving of machinery generally, were, at one blow, cleared away. By its means the formation of every geometrical figure became a matter of the greatest ease, and a principle of absolute and unerring exactness took the place of manual dexterity.

"The impulse given by the slide principle, to the manufactures of this country, in the construction of machines for forming other machines, can scarcely be imagined. On the application of an unerring principle to *machine-making machinery*—which *tools* may be defined to be—the mechanical energy of Great Britain, sprang forward at once to that supreme station which she now maintains, and which, if her artisans keep pace with the times, she will ever retain."—*Note by a Practical Engineer.*

There is no doubt that such difficulty has mainly led to much of the beauty and variety of plan observable in Dr. Abendroth's house at Hamburg, built by the author between the years 1832-6, and which here forms the principal subject of his volume, being illustrated not only by four plans, and elevation, and a section, but by two perspective views, (one of the staircase, the other of a semicircular apartment), but also by several plates of details. The façade of this mansion or *palazzo* is in what may be called a Grecianized Italian style, much of the detail being evidently of the former character, though the composition and its general features stamp it as decidedly belonging to the latter. Although it is *astylar*, or columnless, it is greatly more decorated than almost any specimens of the class we have in London—much more so, in fact, than two which are likely to be quoted as among the very few that can be named at all, viz., Sutherland House, and that of the Duke of Wellington; since both of them are in an exceedingly cold and bald style of architecture, and with a remarkable poverty of feeling about them; and extreme meagerness and flatness of detail. It is, however, in the interior of this mansion that the architect has cheifly manifested his talent, by much happy invention, contrivance, and taste; and a careful study of the plans will show that there is a great deal of effect which is not very apparent upon a cursory inspection of them. So far from complaining that this single subject occupies too many of the plates, we could have wished one or two more had been devoted to it, either as additional sections, or exterior views, one of which ought, of course, to describe the small oblong hexagonal cabinet, with a semicircular alcove occupying the side facing the centre window; which unusual form—so pleasing in itself, and throwing so much variety into the suites of rooms, has been occasioned entirely by the awkwardness of the site, and the disagreeably sharp angle, the two fronts would else make at that corner of the building. The stair-case is exceedingly tasteful, and exhibits what we take to be altogether a novelty—having never before met with, nor heard of, any similar instance, namely, an internal pediment over the colonnade, produced by the ceiling being composed of two inclined planes, each half of which, where they unite at their ridge, is glazed to serve the purpose of a sky-light.

"The great saloon is adorned with casts of Thorwaldsen's frieze of the triumphal entry of Alexander into Babylon, the more valuable because the greater part of the casts were taken from the clay models of the master.

"The colossal busts of the divinities in the niches of the stair-case, are the work of Seigel. The images of the planets and fixed stars of the painted glass ceiling are from the designs of Edwin Specker. The corner cabinet of the principal story is decorated with arabesques, after designs by the same master, painted in encaustic, by Milde. Unhappily, it was too difficult to represent such sportive fancies in their forms and colours in these outline plates."

After making some of the remarks we have done, it would be preposterous in us now to say that the volume consists entirely of the author's best specimens; though it contains much that is of great interest, we are persuaded that M. de Cheteauneuf could render it more valuable; and we hope that either another edition, or anothe collection, will afford him the opportunity of profiting by our criticism; and if our praise has been somewhat qualified, where we have bestowed it has been sincere—and had there been less striking merit in some of the designs, we might, possibly, have thought better of others among them, than we now do.

Euclid's Elements of Plane Geometry, with Explanatory Appendix, and Supplementary Propositions. By W. D. COOLEY, A. B. London: Whittaker and Co., 1840.

Mr. Cooley, in producing this work, seems almost to wish to contradict his own motto, that "there is no royal road to geometry," for following in the steps of Playfair, he has considerably diminished both the volume of the work, as well as the labour of the student. He has carefully gone over the elements, and greatly reduced the amplications and reiterations, which made former editions prolix, and he has, wherever it was possible, substituted the ordinary arithmetical and algebraical signs. As he himself says, without in the slightest degree injuring the work he has reduced to 120 duodecimo pages the Six Books of the Elements.

Prefixed to the Elements are some remarks on the study of mathematics, as valuable for the elegance of their style, as for the correctness of their reasoning. The importance of departing from the ordinary school rate of teaching cannot be too strongly enforced.

At the end of the work are some notes and exercises on the several books, in which Mr. Cooley gives his reasons for inserting a few fanciful definitions of Playfair. To Playfair we are much indebted, but it must not be forgotten that he was often led away by his turn of mind into mere verbiage, making distinctions without a difference.

Outline of the Method of a Conducting Trigonmetrical Survey, by LIEUTENANT FROME, Royal Engineer, F.R.A.S., and A.I.C.E. London: Weale, 1840.

This is the production of one of the Professors in the Military College at Chatham, and supplies a great desideratum in professional literature. Lieutenant Frome is both practically and theoretrically qualified for this task, and has, therefore, produced a work valuable for its own original merits, and for its careful collation of the best authorities. It shows very strongly the mischief of a government system that a man of such experience and capabilities should be only a Lieutenant, waiting like his less talented and less employed brethren for the Procrustean reward of a rise by seniority.

The work is well arranged, and of a high character going into the practical details of the subject much more deeply than its modest title would induce the reader to believe. From a work of this nature it is difficult to make any selection, but we intend at some future period to extract two or three supplementary portions. We must leave it, therefore, to our readers to take our word for the valuable character of Lieutenant Frome's work.

Ornamental Gates, Lodges, Pallisading and Rails of the Royal Parks, &c. Part 1, containing 25 Plates, Edited and Published by JOHN WEALE.

The designs are principally the Park Lodges and Entrance Gates of Regent's Park and Hyde Park—the elaborately enriched gates to the royal entrance of the New Palace, and the gates and railing to the entrance of the Sultan's Palace, at Constantinople. There are also plans of St. James's Park, Kensington Gardens, and Regent's Park. The whole are very delicately and beautifully engraved in outline.

The Guide to Railway Masonry, by PETER NICHOLSON.

This work is a complete treatise on the Oblique Arch, and contains numerous engravings, illustrating the subject. The author has devoted considerable pains in giving every detail by which a working mason may be able to set out any part of the stone work of a bridge with facility.

The Comic Latin Gramar has been sent to us, a work most admirably illustrated. Whether the design be jest or earnest we do not know, but it is likly to be an equal favourite with the elder as well as the juvenile part of the community.

Voltaic Engraving.—Considerable interest has been lately excited in the scientific world by Mr. Spencer's new process of copying medals and other works of art in copper, by the agency of voltaic electricity. It is with great pleasure that we hear that this process is already beginning to be employed in certain of our manufactures, and that thus electricity will soon be numbered amongst the agents employed for practical and useful purposes. In our former account of Mr. Spencer's invention we spoke highly of the merit of the discovery, and the probable uses to which it might be applied: the result has borne out our anticipations. In the manufacture of plated articles and ornaments. it is often desirable to copy ornamental work, such as leaves, flowers, and arabesque mouldings; this is both difficult and expensive, and from these causes often impossible. Mr. Spencer's invention, however, affords a cheap and easy method of performing what is required, and thus, ornaments on rich ancient plate are copied with the greatest perfection and ease, and without injury to the original. The great advantage consisting of the means of obtaining, at very small expense, a fac-simile in copper, of the ornaments required to be copied, which may then be silvered or gilt. In another art, the voltaic process is, we are informed, being successfully introduced. The makers of buttons often require to have two or three of a particular pattern to complete a set of which they have not the die. To take a cast from the button is, for many reasons, inconvenient and objectionable; and the voltaic process, at the cost of a few hours and very little labour or expense, furnishes a perfect fac-simile of the button, which then only requires to be gilt. It has been said that there is a difficulty in obtaining perfect copies, and that the deposited copper is brittle, porous, and full of holes; but whoever will read attentively the process of Mr. Spencer and follow it, must succeed. The cast of medals transmitted to us by Mr. Spencer, and also those made by Mr. E. Solly and Mr. J. Newman, and exhibited lately at the meeting of the Society of Arts, were very pure and compact copper, and the surface was as brilliant and perfect as could be desired. The process, indeed, is simple, and so far from its requiring, as is generally supposed, either expensive and complicated apparatus, or deep scientific knowledge, nothing can be more easy, as the observance of a few rules renders the success of the process quite certain, and, as regards the expense of the apparatus, the whole of it may be easily procured for a few pence.—*Athenæum.*

LAW PROCEEDINGS.

THE CYCLOIDAL PADDLE-WHEEL.

Mr. Galloway's patent right, which has been disputed ever since the patent was granted, was brought on for trial in the Court of Common Pleas, on Friday and Saturday, November 29 *and* 30, *before* Lord Chief Justice Tindal, *and a Special Jury; it occupied the Court two days.*

GALLOWAY AND ANOTHER V. BLEADEN.

The case on the part of the plaintiffs was that Mr. Galloway had invented an improved paddle-wheel for propelling steam-vessels, for which he obtained a patent on the 18th of August, 1835. The invention consisted in a division of the floats into segments, and so arranged in a cycloidal curve as to cause all the five or six segments into which each float was divided to enter the water at the same time, and at such an angle as most diminished the shock occasioned to the vessel by each stroke of the paddle; whilst the segments, when the float reached a vertical position in the water, became joined together as it were, so as to present an undivided surface to the water, and so increase the power of propulsion; and lastly, the float, when passing out of a vertical position, by becoming again divided, offered less resistance to the back water, and, consequently, less retarded the speed of the vessel than if undivided. The action was brought against the defendant, as secretary to the Commercial Steam-packet Company, for an infringement of this patent; to which he pleaded, in addition to the general issue of not guilty, that the invention was not new, as it had already been discovered and used by Mr. Field in 1833; and that the specification was not sufficiently intelligible to render the invention of general utility to the public. Several models illustrative of the alleged invention, were produced, and a comparison made between them and models of the wheels of two of the defendant's vessels, the Grand Turk and the Chieftain, to show that the latter were made upon the principle of the plaintiff's specification. Witnesses were also produced to prove that workmen of competent skill could make the patent wheels from the information contained in the specification, and that the improvement in question was not known in the trade previously to the date of the plaintiff's patent.

The defendant's counsel relied mainly on the ground that the invention had been discovered and used long before the date of Mr. Galloway's patent by Mr. Field, of the firm of Maudslay and Field; and that gentleman, being called as a witness, stated that in 1833 he constructed a wheel on the improved principle now in question, which, upon application to the Lords of the Admiralty, he obtained a promise from them that he should have an opportunity of trying upon the first vessel that came to be prepared; that opportunity, however, was never afforded him, but he made an experiment upon a steam-boat, called "The Endeavour," plying between London and Richmond, by substituting one of his improved wheels (of which a model was produced in court) for one of the Endeavour's wheels. At the end of six weeks, however, the new wheel was removed and the old wheel replaced; because, according to the statement of the captain, the boiler was not large enough for the machinery to work it properly. In that same year he entered a *caveat* at the Patent-office; and in 1835 he made a great number of experiments on the subject at his manufactory; but it was not until the spring of 1836 that he fitted up a vessel called the Dover castle with wheels upon the improved principle, which were similar to the wheel tried upon the Endeavour in 1833.

The defendants, it was urged, had twice acknowledged the plaintiff's patent right, having on one occasion purchased their patent wheels for one of their vessels, and on another, in 1837, paid them 50*l.* for a licence to use their specification in constructing wheels for them.

The Lord Chief Justice summed up the case to the jury, and left three questions for their decision; namely, whether there had been any infringement of the plaintiff's patent by the defendants: whether the invention was new and unused at the date of the plaintiff's patent; and whether the specification was sufficient. With respect to the principal question, as to whether or not the invention was new, the mere fact of a series of experiments having been prosecuted previously to the attainment of the object to which they were directed, could not prevent another inventor from availing himself of the experiments, and then adding the final link which was necessary to bring them to a successful issue. If, therefore, the jury thought that up to the month of August, 1835, the date of the plaintiff's patent, all that Mr. Field had done rested in experiments, those experiments afforded no ground for disturbing the plaintiff's patent, and in that case their verdict should be for the plaintiffs.

One of the jury wished to ascertain whether the wheel tried on the Endeavour was on the principle of the cycloidal curve; or, if the model of it were not in evidence, whether it might not be examined and compared with the original by some competent person.

This question gave rise to some discussion between counsel; ultimately,

The learned Judge said that, as the person who had made the model was not present, he could not allow it to go before the jury.

The jury then returned a verdict in favour of the plaintiffs, with nominal damages.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

ARCHITECTURAL SOCIETY.

INSTITUTED A.D. 1831—SESSION 1839-1840.

5th Nov., 1839.—William Tite, *Esq., President, in the Chair.*

This evening's meeting, the commencement of the session, was devoted to a conversazionè. It was very fully attended. The Secretary read the report of the committee. The President read a highly interesting paper "on the sculptured writings found on the architecture of the Egyptians, with a notice of the discoveries which led to their being deciphered."

The attention of the meeting was directed to the several works of art which were about the room—noticing more particularly various models in terra-cotta, from Messrs. Sollin, Monton, and Co.'s establishment, of the Strand; also a model of an Egyptian obelisk in black marble, together with other models of buildings, &c. Some original sketches by Mr. George Moore; portfolios of prints, by Hawkins and others.

Report of the Committee.

Gentlemen—This evening being the opening conversazioné of the session, it may naturally be expected by the visitors and members who have kindly favoured us with their attendance, that the Committee should state the views they, on behalf of the Society, intend to adopt during the present session, and at the ensuing evening meetings; and they trust that the suggestions which have been offered, and which they propose to adopt for the further carrying out of the objects of the Society may produce an increased interest in their evening meetings, and may meet with the concurrence and personal exertions of the members generally for their fulfilment.

The Committee first remark that they have been successful in securing the assistance of Messrs. Addams and E. W. Braley, jun., (as Professors) to deliver lectures at the monthly meetings, and that on the intermediate evenings of meetings they have procured the promise, on the part of several of their own members, to deliver lectures, or otherwise to read papers having reference to matters of architectural practice and interest, the subjects of which, in all cases, it is proposed should be announced at the previous evening meeting.

Secondly—the Committee considering that this mode of instruction (by lectures) is provided, more particularly for their class of Student Members, propose, as a means whereby these advantages may be made the more available to the interest of that class, that the Student Members should take notes of the several Professors' lectures, and as a stimulus to a due attention to this portion of the benefits offered to them by this institution, have determined that the subject for the prize usually given for the best essay should be "The best fairly transcribed notes of the Professors' lectures."

And while on the subject of prizes, the Committee have the pleasure to announce that they have received the list of the subjects from the Sketching Committee, for which the premiums will be awarded to the class of Student Members, at the close of the present session.

The prizes to be awarded are—in the first class, design, a pair of silver compasses; second class, drawing, Chambers's Civil Architecture (Gwilt's edition); third class 5th volume of Britton's Antiquities. Beside these prizes, which are given by the Society, the Committee have the pleasure to announce that Mr. George Mair has signified his intention to award the usual prize, entitled George Mair's prize, to be given to that student who produces the greatest number of the most approved sketches from given subjects; the sketches to be made in accordance with the directions of the Sketching Committee.

FIRST PRIZE.

The subject for the design is a concert room, with the entrance, vestibule, and cloak rooms—the length of the concert room to be 80 feet, with a gallery at one end. The orchestra to consist of an isolated raised platform on the ground floor.

The style to be either the Greek or Roman architecture.

The drawings to consist of plan, longitudinal, and transverse sections, front and side elevations, to a scale of 1-6th of an inch to a foot; to be accompanied by a prespective view, and the drawings to be finished in Indian ink, or Sepia

SECOND PRIZE.

The subject for the measured drawings is the colonade to Burlington House.

The drawings to consist of the plan and elevation to the scale of 1-6th of an inch to a foot, with the plan and elevation of one compartment to the scale of ½ an inch to a foot, and details of the order ¼ the real size.

The whole of the prizes will be inscribed.

The Committee, not unmindful of the advantages and encouragement the Society receive from the Amateur Members, beg to state they have determined to extend the privileges of that class of members, and that those gentlemen may henceforth, in addition to their former privileges, also have reference to, and the use of, the Society's library and documents at all times of the day, without any restriction; and the Committee trust that this arrangement, which places their privileges on a level with those of the members themselves, so far as the use of the Society's rooms is concerned, may meet the views and wishes of that portion of their members.

In conclusion, the Committee have the pleasure to remark that during the recess several additions have been made, both to the library and museum, and it is hoped that, under the able counsel of their excellent President, the united co-operation of the members themselves, and the flattering support elicited from the attendance of the visitors, that the Architectural Society may have the gratification of finding that the meetings of this session may be as advantageously and as satisfactorily concluded as those of its former sessions.

19*th Nov.*—WILLIAM TITE, *Esq., President in the Chair.*

Mr. BLYTH read a paper on commemorative monuments.

The President announced that Mr. John Blyth (Vice-President) had communicated his intention to give a prize of the value of five guineas for the best drawing of a plaster cast of the human figure, from some specimen in the possession of the Society. The prize to be awarded at the close of the session, and to be described accordingly.

At the solicitation of the student members, the President announced the subjects which had been selected for the prizes, and the resolutions passed last session, assigning the qualifications for the competitors for the prizes were referred to, and read as follows:—"That no student shall be allowed to compete for either of the prizes awarded by the society, who shall have completed his articles, and that the society only award the prizes to students under articles."

Also, "That the same regulation do apply to any private prize, which may be offered for the further encouragement of the class of student members."

3*rd December*, 1839.—WILLIAM TITE, *Esq., President, in the Chair.*

The President gave notice that the subject selected for Mr. Blyth's prize was the figure of "the Atlas." The figure to be drawn 18 inches high, and to be shaded in lines with pencil or ink.

The meeting was then favoured by a very interesting and instructive lecture by Mr. Hemming, the subject of which was "Iron."

17*th December*, 1839.—WILLIAM TITE, *Esq., President, in the chair.*

The President gave notice that the Hon. C. Cavendish had given his assent for the students to measure the colonnade of Burlington House; and that, by the obtaining of which the committee were enabled to complete the list of subjects for the prizes to be delivered at the close of the session.

The President read the list of subjects as prepared by the committee, together with the rules and regulations to be observed by the students competing for the same. The list of subjects, &c., was ordered to be be hung up in the society's room.

The President announced a donation from the Archutectural Society of Berlin of the third volume of the Architects' Album, published by that body.

Mr. Addams delivered a lecture "On the strength of beams to resist pressure and impact." He referred to iron as well as wood; and in the course of the lecture gave some excellent tables, whereby an easy calculation might be made as to the weight any iron beam would carry.

Mr. Pocock explained to the meeting a new material he had manufactured for the purpose of roofing in lieu of slating, &c., a specimen of which was lying upon the table.

STEAM NAVIGATION.

THE 'CYCLOPS' STEAM ENGINE.

ON Friday the 13th of December, this splendid vessel left her moorings at Blackwall, for a trial trip down the river, and to proceed to Sheerness to take in her guns and equipments. This being the largest steam frigate in the world excited much attention, and throughout her passage down the river, was an object of great curiosity and admiration.

The trial was made under the directions of the Lords of the Admiralty and their officers, several of whom were on board, viz., Sir C. Adam, the Secretary of the Admiralty Mr. Moore O'Ferrall, Sir E. Parry, Sir William Symonds, Captain Nott, Captain Austin, &c. &c.

Her performance was most excellent, the speed was found to be about 10 knots, or 11½ miles, her engines working 21 strokes; and it was universally remarked that there was an entire absence of the unpleasant tremulous motion so generally found in other steamers.

After proceeding close to the Nore Light, she turned and met the "Fearless" Admiralty steamer, which accompanied her down, and their Lordships embarked in that vessel to return to Woolwich, while the "Cyclops" proceeded up the Medway, and made fast to the buoy off Sheerness Dock-yard.

This vessel was planned by Sir William Symonds, and built under his immediate superintendance at Pembroke dock-yard; she combines in a most eminent degree the qualities of both sailing and steaming, together with such improvements as have suggested themselves to her designer from the experience of the "Gorgon."

She is propelled by two engines of 160 horse power each, made by Messrs. J. & S. Seaward and Capel, on the new principle adopted by them, by which they dispense with the large cast-iron side frames and sway beams, the cross heads, side rods, &c., &c., and thus bring the weights of these engines to 70 tons less than they would have been, had they been made on the common beam principle; and thereby also effect a very important saving of space in the length of the engine room. These engines are fitted with a contrivance (which is protected by patent) for warming the feed water on its passage to the boiler, by causing it to pass through a number of copper pipes around which the spent steam from the cylinder circulates, on its way to the condenser; by which means the temperature of the feed water is elevated about 60 degrees above the usual temperature, at which it enters a boiler, and a saving effected in the consumption of fuel of seven per cent.

There are four copper boilers for supplying the above with steam, made entirely of copper, and placed in pairs, back to back, with a fore and aft stoke hole; these boilers are clothed on the system first used by Messrs. J. and S. Seaward and Capel, and since introduced into the navy for Her Majesty's steam ships, for the prevention of the radiation of heat; the advantages of which were evident in the surprising coolness of the engine room. A barometer placed against the side of the boilers only rose to 68°, and another in the stoke-hole to only 72°.

The boilers are fitted with a patent apparatus for detecting and indicating the state of saltness of the water in the boiler; and also with a receiver and apparatus for blowing out, when the time for that operation has arrived; by means of which all danger from salting the boiler, or blowing out the water too low, is entirely obviated; and the boiler may be worked as long with salt water as with fresh.

There are coal-boxes placed on each side of the vessel the whole length of the engine room, and holding when full about 450 tons of coals. The consumption of fuel by actual weight (the coals being weighed during the trial) was 17 cwt. per hour, equal to 6 lbs. of coal per horse per hour.

The "Cyclops" is commissioned by Post Captain Austin, late of the Medea, being the only steam frigate in the navy besides the "Gorgon," of that rank. Her engine room crew will consist of four engineers, twelve stokers, and four coal trimmers.—The actual number of hands including officers and a lieutenant's party of marines, will be two hundred and ten men.

Her dimensions are as follows:—

	Feet.	In.
Extreme length	217	9
Length of upper deck	195	2
Width across paddle-boxes	57	0
Length of engine room	62	0
Width of beam	38	0
Depth of hold	23	0
Engines—Diameter of cylinder	0	64
Length of stroke	5	6
Diameter of paddle-wheel	26	0
Width of wheel	8	0

Weight of engines, boilers and water 280 tons.

Weight of coals for 25 days consumption, 450 tons.

Draught of water with all her guns, ammunition, engines, coals and stores for six months, 16 feet 6 inches.

Tonnage, 1,200 tons.—Power of engines, 320 horses.

The armament of the "Cyclops" will consist of—on the upper deck two 98 pounders; one at the stem, and one at the stern.—Four 48 pounders.

On the gun-deck, sixteen long 32 pounders.

Russian War Steamer, "Pylades," and "The Sons of the Thames."

This vessel is the last of three which were ordered for the Russian government, and of which the two others have already proceeded to their destination. She went down the river on Wednesday the 18th ultimo, on an experimental trip to Gravesend, accompanied by the Russian Consul and a large party invited by Messrs. Miller and Ravenhill, the engineers who manufactured her machinery, to witness this first trial of her engines, we repaired to Blackwall a little before 11 o'clock (the intended hour of departure), and found that the Pylades had not yet left the docks, and that some time would still elapse before she could be out into the river, in consequence of a large vessel being then on the point of entering the docks. This delay afforded us an opportunity of observing the form of the steamer's hull, which was built by Mr. Pitcher, from drawings by Mr. Ditchburn, to whose talent as a naval architect, the model, if we may judge from the part which appears above water, does great credit.

During this time our attention was directed to a small iron steam-boat, built by Mr. Ditchburn, and fitted with a pair of engines of 28 horse power each, by Messrs. Miller and Ravenhill. She was also going down to Gravesend on her first trial, and while waiting for the Pylades she made several trips in front of the dock entrance to the admiration of all present. She was evidently going at a great speed, but seemed at the same time to cleave the water with such ease as to cause no disturbance whatever in the fluid for there was neither spray nor any perceptible wave against her bows, which speaks strongly for the correctness of the principles followed by Mr. Ditchburn in laying off her lines.

As soon as the Pylades could be got out of the docks, which was not until about 12 o'clock, we proceeded down the river, but owing to some little adjustments which it was discovered were still required to be made in the engines, in order to allow them to work up to their power, the performance was not so good as could be wished, notwithstanding which the engines worked very smoothly, causing little or no vibration in the vessel. The time of running the measured mile at Long Reach was noted on our way down with the tide, but against a rather strong head wind: the distance was performed in 5 min. 47 sec., which gives a speed of nearly 10½ miles an hour over the ground. To ascertain the rate through the water it would be necessary either to deduct or eliminate the velocity of the tide; but, as the engines were not working up to their speed, it was not considered worth while to make the experiment against the tide, so we went on to Gravesend, where we arrived a little before 2 o'clock, and found the "Sons of the Thames" waiting for us. As it had been arranged that the whole party should return to Blackwall on board that boat, she was brought along side of the Pylades, and took the company on board, by which time it was 20 minutes past 2 o'clock; we then started, the Planet, belonging to the Star Company, having left the pier a quarter of an hour before. In the course of one hour we overtook her, and, having gone a little farther, we put about and returned some distance to take a gentleman on board, and passed the Planet again before we arrived at Blackwall, having in the mean time gone completely round her. It is calculated that, in order to do this, we must have been going at the rate of 13½ to 14 miles an hour through the water. This comparative speed with the Planet is the more astonishing as the "Sons of the Thames" has two engines of only 28 horse power each, whilst the Planet has two engines of 40 horse power each.

It may not perhaps be generally known that the iron steam boat, the Orwell, now running between London and Ipswich, which we believe equals, or even excels the "Sons of the Thames" in speed, was also fitted with engines by Messrs. Miller, Ravenhill and Co., and built by Messrs. Ditchburn and Co., so that we may confidently look forward to the time (which we believe not to be far distant), when the speed of our steamers on the Thames shall not only come up to, but even exceed that said to be attained in America, and that with a comparatively small expenditure of power; for if it is not notorious, it is at least known in this country, that the power put into the American steam boats is most gigantic.

New Iron Steamer.—On Saturday the 7th ult., the iron steamer "Enterprise," built and fitted out by Mr. Borrie, of the Tay Foundry, started on a trial trip to New burgh. The model of the hull is certainly beautiful, and at first sight any one must be of opinion that the elements of form calculated to promote rapid sailing are possessed by the "Enterprise" in a very eminent degree. The entrance and runs are very sharp, which, united with the great bearing in the floors render the vessel buoyant, and secure an easy passage through the water. The anticipations formed of her speed were fully realized. She sailed a measured distance of four miles marked on the shore in the space of 12 minutes. The tide was in her favour, and admitting it to have been running at the rate of four miles an hour (although it was under that rate) would make the actual distance performed by her over the ground at the rate of 16 miles an hour, a speed that has not hitherto been attained by any steamer. It may be remarked that this speed is not so much attributable to the great power of the engines as to the form of that part of the hull immersed in the water; and indeed Mr. Borrie states, that in making his calculation for procuring a given speed, he placed a greater reliance on lessening the resistance that would be experienced by the vessel in passing through the water for obtaining a high velocity, than by dependence on great propelling power. In this he has decidedly succeeded, as the result amply proves. The vessel measures 280 tons, and has two engines of 35 horse power each, which is a power much less in proportion to the tonnage than that of many steamers which would not sail 10 miles an hour, and at the same time having a sectional area of resistance not greater than that of the "Enterprise." A striking feature in the "Enterprise" is the consumption of smoke. This is effected by a plain and very simple contrivance in the interior of the furnace. The furnace bars instead of being straight are curved on the upper surface, and are so adjusted in the furnaces as to form a very acute angle with the front of the boiler at the furnace doors, whilst towards the posterior extremities they are horizontal, in other respects they are similar to those in general use The furnace covers deflect about 18 inches into the furnaces, within two feet of the inner end, which forms a water chamber. The distance between the upper surface of the coals when the furnaces are fully charged, and the under surface of the deflector, is about six inches. The coals for every new feed being deposited in the anterior part of the furnace, which is fully two-thirds longer than the posterior part or space behind the deflector, it follows that the coals before requiring to be pushed back into the space behind the deflector must have become very highly ignited and the component parts which cause the emission of smoke entirely disappear. Then the posterior fire chamber being always charged with fuel which only emits a pure and intense flame, the smoke arising from the coals in the anterior chamber having to pass underneath the deflector come immediately into contact with the flame in the posterior chamber, and having to pass through in its way to the flues is exposed to its most intense action, whereby it is immediately consumed. The dimensions of the "Enterprise" are,—Length of keel, 116 feet; breadth of beam, 21 feet; depth of hold, 8 feet.—*Dundee Courier.*

Steam Navigation across the Atlantic.—Early next spring, and during the year, there will be placed on the several lines three new steamers to ply between England and New York, and Mr. Cunard's steamers to Boston, by the way of Halifax, will go into operation. Two of the three, the *New York* and *President*—the former for the Transatlantic Company, and the latter for the British Queen Association—are nearly ready for launching; and the *New York* will probably leave England in April or May, and the *President* in Jun or July. The third is now building for the Great Western Company, andwil be constructed of iron. She will not be ready before next September or October. These, together with Mr. Cunard's, which will commence running in May next, will keep open a free communication with Europe without the aid of "windy" vessels. Together, they will form a line so that there will be two departures from England and two from the United States every month. In addition to these, the keel of another steam ship, to be of 1,450 tons, and 450 horse-power, has already been laid for the Transatlantic Steam Company, to run in connection with Liverpool and New York. She will not be finished before the spring of 1841; and also by that time there will be two large and splendid steamers ready to start from the Clyde, and run across to New York. With steamers, as with sailing packets, the builders improve with every new vessels. It it said by those who have seen the plans of the new steamers, that the improvements adopted will place them on a par with our packet-ships in point of comfort, &c. The Atlantic will soon be as thickly dotted with steam-ships as with sailing vessels.—*New York paper.*

Port of Fleetwood.—The commissioners from the Court of Exchequer, sent down for the purpose of surveying and setting out the boundaries of the Port of Fleetwood, finished their task yesterday se'nnight. They commenced on the previous Monday to survey the coasts and creeks between Lancaster and Preston, and determined the limits of the port as follow:—To commence at a run of water called the Hundred End, about two miles to the west of Hesketh Bank, continuing up to Preston, thence along the coast on the north side of the river to Lytham, round the coast to Blackpool, and on to Fleetwood; thence to the river Broadfleet, four miles from Sea Dyke, including both sides of the Wyre, and the river Broadfleet.—*Preston Pilot.*

The British Queen is not intended to be started for New York on the first of January, as previously advertised, the proprietors being of opinion that one very serious impediment to the speed of the vessel is in the inferior construction of the paddle-boxes; and, accordingly, a new description of paddle, called "The Reefing Paddle," is about to be substituted—this new paddle being the invention of the celebrated Mr. Samuel Hall.—*Midland Counties Herald.*

ENGINEERING WORKS.

The Hull Dock company are about applying to Parliament for making an extensive dock and entrance for the large class of steam boats, &c. on the east side of the river Hull.

Woolwich Dock-yard.—In the November number, we inserted a paragraph from the "Times," stating that the new dry dock, making at Woolwich, and other works, were under the charge of Lt. Dennison; upon enquiry, we find that the new dry dock now on hand at the east end of the yard, is being constructed under the direction and superintendance of Mr. Walker, by Messrs. Grissell and Peto.

New Pier at Margate.—This pier, which is intended to rival that of Ramsgate, as a refuge harbour for her Majesty's steam-vessels, &c., is, we hear, to commence at the Wayland and Fulsam rocks, from the facility arising from their receiving the piers on a foundation of solid chalk, extending 1000 feet from the gateway to the sea at Westbrook. The second point, opposite the fort, next the East Cliff, is intended to be 500 feet, leaving an opening for vessels to the extent of 400 feet.—*Advertiser.*

Cowes.—It is now expected that Sir John Rennie's plan for deepening the Medina will be carried into execution. A spacious town-quay will also be erected, and it is rumoured that the members of the Royal Yacht Squadron are about removing their rendezvous from this place to the anchorage off Norris, on which estate a splendid club-house is to be built for the accommodation of its members.—*Hampshire Telegraph.*

Proposed new road from Perth to Elgin.—A meeting was lately held at Elgin on this important subject, when a number of proprietors and gentlemen of the town attended, including the Duke of Richmond. Mr. A. Mitchell, civil engineer, Perth, attended with a report he had drawn up on the subject, as to the probable expense, &c. of the new line. The estimates, framed on a minute survey he calculated would not exceed £23,000. The probable revenue to be derived from tolls, Mr. Mitchell estimated in all at £1530. After Mr. Mitchell's statement and report, the meeting passed a series of resolutions, appointing a committee to prepare a memorial to Government soliciting pecuniary assistance, as also the aid of the members of Parliament connected with the northern counties and burghs.

Shoreham Harbour.—The new pier at the entrance of the harbour has been carried a considerable distance into the sea, and though it will doubtless improve the harbour, it checks the travelling on the beach between Brighton, and in case of high tides may occasion considerable inconvenience.—*Brighton Herald.*

Teignmouth Bridge, Devon.—It may be fresh in the recollection of our readers that a very considerable portion of this bridge suddenly fell in June 1838, caused by the destruction of the timber piles from the ravages of the worm. The restoration was only commenced in the early part of the autumn, by direction of Her Majesty's Commissioners for Exchequer Bill Loans, from the plans of Messrs. Walker ahd Barges. If we may judge from the progress already made, and the number of workmen employed, there is every prospect of the bridge being again made passable to the public in the course of a couple of months. We regret having omitted noticing this work before, as we attach greater interest to works of this description (after failure) than in the first construction. We hope again to refer to this subject with a more detailed account of the plans adopted.

PROGRESS OF RAILWAYS.

Grand Junction Railway.—A good deal of inconvenience and trouble were occasioned a few days ago to the passengers on the railway, and the servants of the company, by "a slip" or fall of a great portion of bank, about seven miles on this side Birmingham. At that point there is a very deep cutting, the bank on one side of which, having been loosened by the late incessant rains, was shaken down by the passing of the six o'clock train, on Saturday morning last. The engine was partially covered by the mass of earth, but providentially no injury was sustained by any of the passengers. Another engine was obtained to forward the train, which was, of course, delayed considerably beyond its usual time, as were also the other trains which followed; the passengers and luggage having to be transferred from one train to another before they could proceed, both lines of rails being entirely covered with a vast quantity of earth. We understand that the line was not cleared so as to allow of the passage of trains until Monday.

Great Western Railway.—The works of this railway, between Dudast and Farringdon, are so far advanced, that we understand the directors confidently expect to open the line nearly thirty miles beyond Reading, about the same time as to that town itself: in which case, upwards of sixty miles of the London division will be open for public use in the spring, and the line between Bristol and Bath at the same time.

North Midland Railway.—The contracts for the Eckington, Chesterfield, and South Wingfield stations have been let to the following parties:—Eckington, to Messrs. Smith and Brown, of Sheffield; Chesterfield, to Messrs. Leather and Waring; South Wingfield, to Mr. Radford, of Alfreton. Total amount, £7,000. The Belper contract is not yet let.—*Derby Reporter.*

Hull and Selby Railway.—On this line all the works continue to be prosecuted as rapidly as the very unfavourable weather allows. About two-thirds of the whole of the iron work of the superstructure of the bridge over the river Ouse, at Selby, are now on the spot, and the men are busily engaged in fixing it; the whole of the ironwork of the bridge over the river Derwent, near Wressel Castle, has arrived there, and two of the ribs are fixed across the river, the greatest portion of the entire length of the railway is ballasted, and the contractors are busily engaged in laying the permanent way. We understand that it is highly probable this railway will be completed by Midsummer next, and that in the course of the year, there will be a complete railway communication between Hull and London.—*Midland Counties Herald.*

Glasgow and Ayrshire Railway.—It is truly gratifying to find that the highest anticipations formed of the success of this railway, promise to be fully realized, as a traffic on the limited portion of the line already opened is being created, far more extensive than the most sanguine could have expected. Indeed, this undertaking affords a more than ordinary illustration of the fact, that facility of communication secures traffic for itself. Before the line was opened to Irvine, the intercourse between these places was so very limited, that public accommodation did not demand more than a one horse coach, thrice a week. Now, however, that railway coaches run to and from Irvine thrice a day, and there is a coach stationed at Irvine to carry forward passengers to Glasgow, this route has become quite a thoroughfare. And well do the shareholders of the Glasgow and Ayrshire Railway merit so flattering a prospect of the success of a speculation fraught with such unspeakable advantages to the west of Scotland. The recent return of the number of passengers that have travelled from Ayr to Irvine, during the three months ending the 5th current, (36,832) must give them great confidence, that when the entire line to Glasgow is opened, the traffic upon it will greatly exceed the estimate laid before parliament. Indeed, we believe that the parliamentary proof went no further than to warrant the *annual* traffic in passengers of 32.000, 4,832 less than have already travelled in three months! The line from Irvine to Kilwinning being now on the eve of completion, will be opened in January next, when a large increase of traffic must necessarily follow, from the surrounding populous districts, including the towns of Dalry, Killirnie, Beith, Stevenson, Saltcoats, Ardrossan, &c. The entire line to Glasgow, as is now pretty well known, is expected to be opened in June, 1840.—*Ayr Advertiser,*

North Midland Railway.—The Leeds station, or terminus, we understand, is to be let by contract to-morrow. The Belper station, we hear, is to be built by Hugh M'Intosh, Esq. The bridge for the turnpike road, near Duffield, already known as Moscow-bridge, is nearly completed. Milford tunnel is completed, the last brick remaining only to be laid. The enormous mass of masonry at Belper is rapidly progressing, and the temporary bridge over the wide part of the Derwent, called Belper-pool, is taken up, and the permanent one, nearly 600 feet long, promises to be complete before New Year's Day. The new bed for the river, near Amber-gate, is proceeding with great activity; and the immense bridge of five arches, at the same place, promises completion soon, as we observe centres fixing for the arches, the greater part of two years having been spent, night and day, in getting in the foundations and piers. On the embankments in this neighbourhood, great portions of the permanent way are laid. The difficult undertaking at Bull-bridge, in passing over the turnpike road and under the bed of the canal at the same time, has been easily accomplished, and is all but finished. We observe here water and land piled four stories, one on the other, in a singular manner, thus:—there is first the river Amber, over which goes the turnpike road; over this goes the North Midland Railway; and over the railway flows the Cromford canal. Such a complication of bridges is seldom to be met with. At the station here (Derby) the greatest activity prevails; and there is every indication of an early opening of this line in the spring. A committee of directors, with R. Stephenson, Esq., arrived here by a special train on Monday last, to inspect the works.—*Derby Reporter of Thursday.*

Gloucester and Birmingham Railroad.—The works of this railway, in the neighbourhood of Cheltenham, continue to progress most satisfactorily. The extensive range of buildings near the offices and lodge, already erected, which are designed for the engine-houses, workshops, &c., of the depôt, are in a very forward state, and, unless retarded by the weather, will be all roofed over in the course of a few days. A powerful locomotive engine is now constantly employed in removing ballast, &c., along the line between Cheltenham and Tewkesbury, which portion is so far ready for use, that it is the intention of the directors to make their first experimental trip along it some day next week. The ultimate prospects of this company seem to be most promising.—*Bristol Mercury.*

Eastern Counties Railway Company.—The bridge built by this company over the brook leading from Brentwood to Warley is now finished, and persons travelling that way will find the hill considerably lessened.—*Chelmsford Chronicle.*

Croydon Railway.—The first six months from the opening of this line terminated on the 4th inst.; during that period 311,319 passengers have travelled on the railway, and the money received is £17,666 11*s.* 3*d*,—*Sun.*

Blackwall Railway.—We understand that the Directors have determined upon fitting up an electro-magnetic telegraph along their line, similar to that which we recently noticed as having been for some time in successful operation on the Great Western Railway. In addition to the facilities which such an arrangement will afford in the working of the railway, (an arrangement peculiarly adapted to this line, as we shall take a future opportunity of showing,) the public will be benefitted in no small degree by its application to other purposes. For instance, a vessel coming up the river can, before reaching Woolwich, easily communicate by signals with the railway terminus at Blackwall, and the information being instantaneously conveyed to the Fenchurch-street station, in the immediate vicinity of the great seat of business, parties who are expecting the arrival of friends will at once be prepared to meet them in town, without the necessity of waiting for hours about docks and wharfs; or, if so inclined, can join them at Blackwall, almost as soon as the vessel has reached that point. In the case of steam-boats especially, this will be of great advantage as there can be no doubt that the whole of the passengers by these vessels will at once avail themselves of the railway to avoid the always tedious, and sometimes dangerous, navigation of the Pool. We are glad to find that the works of this short but most important line are proceeding with much vigour, and that the prospects of the Company are in the highest degree satisfactory.—*Railway Times.*

London and Brighton Railway.—Since the opening of the tunnel on the Shoreham branch of the railway, the cutting on New England Farm has made rapid progress; and judging from the appearance of the works, we should suppose that two or three weeks would be sufficient to complete it. The remainder of the line, at the Shoreham end, will, we imagine, take even less time, as only a very few yards of embankment remain to be made, and the permanent rails are already laid on the level of the meadows immediately contiguous to Shoreham. A great number of spectators assemble at New England daily, to witness the ingress and egress of the engine to and from the tunnel. The viaduct over the New England Road, for the London line, is nearly completed; and the progress of the works there, is, we learn, equally rapid and satisfactory with that of the works on the Shoreham Branch, nearer home.—*Brighton Gazette.*

Great Western Railway.—The progress of this immense national undertaking is beginning now to be a work of admiration. Betwixt London and Bristol there are many points of observance showing the wonderful daring results of science which our forefathers never could have anticipated. The wonders of Egypt dwindle into nothing in the comparison. There are gigantic labours without use, the monuments of pride and folly; here use, ornament, and durability seem to try to surpass each other, and their several excellences are so adjusted as to show the foundation of future national prosperity beyond all power of calculation—not only the prosperity of trade by the rapid conveyance of merchandise, but intellectual prosperity, national progress as to mind, by bringing all parts of the empire into more frequent intercourse with large towns, and especially with the metropolis. The most costly portion of the line will be the tunnel at Box. This will ever be in itself a magnificent proof of the skill and enterprise of the age; but these can never be truly estimated, without a knowledge of the overwhelming difficulties encountered in its progress. Of these no evidences will be presented by the work itself, they will be matters only of history. The company deserve high approbation if not national gratitude for their liberal endeavour to make every point of observance an additional beauty to its locality. Even in Bath, the most beautiful city in England, where every thing seems to harmonise in splendour, even here we find the line of works adjacent adding to the general magnificence. The centerings of the arch over the Wells-road, at the bottom of Holloway, have been removed, and erected at the place where the railway will cross Claverton-street. The arch and the two gothic towers are pronounced to be excellent specimens of workmanship; and the entire viaduct, from the taste evinced in its design, will form, when completed, quite an ornament to the neighbourhood. The coffer dam in the Avon, in which the middle support of the proposed bridge will be erected, has not yet been cleared of water, but every effort is being made to effect that object. At the tunnel near Bathwick-terrace the workmen have commenced the formation of a permanent way; and near Hampton-row great advance has been made during the last five or six weeks. At Hampton and the fields beyond, the cuttings and embankments are in a forward state. Close by the stone bridge, between Hampton and Bathwick, the works are also beginning to alter the face of the landscape.—*Bath Journal.*

South Eastern Railway.—The rapid progress of the works is giving quite a lively aspect to Folkestone. The bridge across the Canterbury and Dover road is also completed; and the advancement of the line on either side is going on in a highly satisfactory manner.—*Dover Chronicle.*

Leeds and Manchester Railway.—Rapid progress is making in the construction of the tunnel at the summit between Littleborough and Sodmordon, and it is generally expected that the whole line will be completed in the autumn of the year 1840. The number of passengers now travelling in the railway carriages between Manchester and Littleborough is perfectly amazing and approaches nearly to 3,000 a day; nor is this to be wondered at, when it is considered that it is actually cheaper for a labouring man to ride upon the railroad than to walk upon the highway, as the journey of thirteen miles is performed in half an hour by steam, which would require four hours for a foot passenger, and the fare for travelling in the stand-up-carriages amounts only to one penny a mile.—*Derby Reporter.*

NEW CHURCHES, &c.

Warwickshire.—A new Church is about to be erected at Attleborough, in the parish of Nuneaton, on a site the gift of the Earl of Harrowby. There are upwards of three acres and a half of land, which it is his lordship's wish should be laid out advantageously for the benefit of the clergyman, and it is in contemplation, reserving sufficient for the church, burial ground, parsonage house, croft and schools to form a street of comfortable dwelling houses, the proceeds of which are to form part of the endowment. It is designed by Mr. Thomas L. Walker, in the early pointed style, with a handsome triple west window, and a small tower at the south west angle, containing a clock-room, belfry, ringer's floor, and a staircase leading to a west gallery. At the east end is a semicircular apsis, on each side of which, against the east wall of the church, the pulpit and reading-desk are placed. It is cruciform in plan, a robing-room and a porch forming the arms of the cross. The dimensions of the body, inside the walls, are 73 feet by 39 feet, and is calculated to accommodate 472 persons, viz. 112 in pews, and 360 on benches.

All Saint's Church, Spicer Street, Mile End New Town.—On the 25th of November this church, erected and endowed at the expense of the Metropolis Churches Fund, was consecrated by the Bishop of London. It is designed in the Norman style by Mr. Thos. L. Walker, and has a tower, situate on the south side, tabled off and terminated in a neat square bell turret with an octagonal roof. The body of the church measures 74 ft. 6 in. by 54 ft. 6 in. in the clear inside; the roof is in one span, with a queen truss open to the straining piece, it is slightly ornamented, and the timbers are chamfered; the tie-beams are supported by brackets springing from ornamental stone corbels. The pulpit, designed it is presumed to imitate stone, by the details made use of, is rather inappropriately grained heart-of-oak; it is chaste in style, open underneath to admit of an entrance into the reading-desk. The altar piece is cleverly managed, at a small expense, by arched recesses being formed in the brickwork, wherein the Commandments, the Lord's Prayer, and the Belief, are written in appropriate but perfectly legible characters, the initial letters in red and blue, the rest in black on a stone-coloured ground. The chancel is lighted, not from the east as usual, but from the north and south; by this means the glare, which often proves distressing to the congregation, while regarding the preacher, is avoided, while the rays of light, falling upon the altar table from the south, during the greater part of the day, must tend to produce a pleasing effect. Attached to the Church is a spacious vestry, 24 feet by 16 feet, with a neat Norman fire-place executed in Bath stone, and is provided with coal-cellars, &c. There is accommodation for 1110 persons; the church and vestry were contracted for by Mr. West, of Cannon Street Road, at £4095.

New Churches in Wolverhampton.—On Friday, 22 Nov., the plans for a new church in Horsley Fields, one of the intended three new churches in Wolverhampton, were submitted to a meeting of subscribers, in the large room in the Swan Hotel. The plans were 21 in number, and many of them very elegant designs: they were all in the Gothic style. Five of them were selected for further consideration, and were exhibited to the subscribers at large, at the same place.—*Staffordshire Advertiser.*

PUBLIC BUILDINGS, &c.

Warwickshire.—An extensive Hospital, or range of almshouses, is in course of erection at Bedworth, near Coventry, from the designs and under the superintendence of Mr. Thomas L. Walker. The main building forms three sides of a cloistered quadrangle, which sets back 90 feet from the street; towards the street, on the right hand is a porter's lodge, and on the left a tenement to correspond, each with a neat oriel window, leaving the quadrangle open to view, and an iron palisade, with ornamental brick piers and stone caps, complete the street frontage. It is calculated to lodge 40 pensioners, 20 male and 20 female, each having a separate bedroom and pantry; a sitting-room is provided for every two. In the centre of the quadrangle is a spacious dining-room for the governors of the charity, a committee-room, a steward's office, and a kitchen, with accommodation for a nurse. The dining-room is in the form of the ancient halls, and has four bays attached to it; the porch occupies one, the butler's pantry another, and the two others are open to the room; an ornamental screen at the lower end parts off the passage leading from the porch to the committee-room, &c.; over the two front bays are strong-rooms for deeds, one opening into the steward's office, the other is ascended by a circular stone staircase from the hall itself. From the roof of the hall rises an ornamental bell turret, and clock-room in the form of an ancient Louvre. The whole is designed in the late Gothic style, the windows being square-headed, with mullions and transoms, except those of the hall, which are four-centre-pointed, with mullions and tracery. The whole is to be faced with red bricks, and to have stone dressings to the doors and windows and stone motings. Mr. John Toone, of Leamington, is the contractor for all the works, except the hall roof and clock turret, at £8,500.

Llankovery, Carmarthenshire.—The committee appointed to examine and report upon the designs for a market, met in accordance to an advertisement offering a premium for the best design, have adopted the design of G. Clinton, architect of Cardiff.

MISCELLANEA.

EFFECTS OF LARGE FIRES IN PREVENTING STORMS.

(Translated from the French.)

M. Matteucci had pointed out the practice recently introduced into a parish of Romagna of lighting large fires for the purpose of preventing the formation of storms, and remarked that during three years that this practice had been adopted, the parish, which until then had every summer been ravaged with hail, had been spared, while the neighbouring parishes had not escaped.

M. Arago, when quoting this fact in his notice upon thunder, (*Annuaire du Bureau des Longitudes*, 1839), remarked that such short experience would not allow us to consider the result conclusive, and added that more exact data would doubtless be obtained on this subject, by comparing with those of the neighbouring agricultural districts, the meterological observations of certain districts in which high chimneys and large factory fires are used are very numerous. This comparison, said he, had been already made in England, but the results although in favour of the preservative influence of large fires, did not show this influence free from doubt. In fact high furnaces in England are particularly numerous, where there are many mines; the rarity of storms therefore in these places may just as well be attributed to the nature of the soil as to the action of the large fires, which are required for the reduction of the minerals.

M. Matteucci has now pointed out another locality in which this influence of metallic veins is not mixed up with that of large fires. While travelling in the Apennines, he found that those districts in which charcoal and sulphur are prepared, are not much subject to storms, and are free from hail. He was told that about five years ago a hail storm burst over the parish where the sulphur furnaces are, but the place where they are established was preserved. The place mentioned here is Perticaja, near Rimino, where there is a number of these furnaces.

Mr. Cockerill's Manufactory.—Advices from Liege state that Mr. John Cockerill has set out for St. Petersburgh, taking with him one of the chief persons employed at his works, and three engineers. The Emperor Nicholas, it is added, has advanced Mr. Cockerill 10,000,000f. at 5 per cent. secured on all his establishments in Belgium, Russia engaging to purchase annually, to a certain amount, machinery to be manufactured in them, which is to diminish annually, as the Emperor, assisted by Mr. Cockerill, shall have created similar establishments in his own dominions.—*Midland Counties Herald.*

Rouen.—A design for a tomb to receive the heart and statue of Richard Cœur de Lion, in the style of the 12th century, has been prepared by M. Deville, conservator of monuments in the Cathedral of Rouen. It is proposed to place it in the Chapel of the Virgin in the cathedral, near the tomb of Cardinal d'Amboise; and it is supposed that the execution of it will begin before the end of the present year.—*French paper.*

Encroachment of the Sea.—The sea, it is said, is encroaching upon every part of the Cornish coast. In the memory of many persons still living, or but lately dead, the cricketers were unable to throw a ball across the Western Green between Penzance and Newly, which is now not many feet in breadth, and the grandfather of the late vicar of Madron is known to have received tithes from the land under the cliff of Penzance. At a very remote period, we are assured by tradition, that a considerable part of the present bay especially that comprehended within a line drawn from near Cuddon Point, on the east side, to Mousehole on the west, was land covered with wood, but which, by an awful convulsion and irruption of the sea, was suddenly swept away. There is a letter extant, written in the reign of Charles II., to the then proprietor of an estate, which included part of the Western Green, and that part is there estimated at 36 acres of pasturage.—*Penzance Gazette.*

Egypt.—Machines have been brought from England to drain the marshes at Alexandretta, where the stagnant waters fill the country with malaria. The same cause propagates fever in the Egyptian army at Marasch, Adana, and other places. The hospital service is very badly arranged.

Royal Belgian Steamers.—The Belgian Government, in the budget of the Minister of Public Works, alluding to the marine, notifies that "a separate project will be submitted to the Chambers to meet this expense, whether by means of a transfer, or by means of a special credit, destined to complete the system of the railroad by some steam-boats." This measure of M. Nothomb, which is considered, even by the leaders of the Opposition, to be the ablest one projected since the settlement of the country, is the favourite of M. de Theux, and said to be impressively sanctioned in the highest quarter.

LIST OF NEW PATENTS.

GRANTED IN ENGLAND FROM 2ND DECEMBER TO 24TH DECEMBER, 1839.

George Davey, of Llandudno, County of Carnarvon, Mining Agent, for "*an improved mode of applying water-power*."—Sealed December 2; six months for enrolment.

Luke Hebert, of Birmingham, Patent Agent, for "*improvements in the mechanism and process of packing and pressing various articles of commerce.*" Communicated by a foreigner residing abroad.—December 2; six months.

Miles Berry, of Chancery Lane, Patent Agent, for "*certain improvements in machinery or apparatus for making or manufacturing pins and sticking them in paper.*" Communicated by a foreigner residing abroad.—December 2; six months.

Godfrey Anthony Ermen, of Manchester, Cotton Spinner, for "*certain improvements in machinery or apparatus for spinning, doubling, or twisting cotton, flax, wool, silk, or other fibrous materials, part of which improvements are applicable to machinery in general.*"—December 2; six months.

John Evans, of Birmingham, Paper Maker, for "*improvements for chemically preparing and cleansing of felts used by paper manufacturers.*"—December 2; six months.

Henry Dunington, of Nottingham, Lace Manufacturer, for "*improvements in machinery employed in making frame work knit, or stocking fabrics.*"—December 2; six months.

James Guest, Junior, of Birmingham, Merchant, for "*improvements in locks and other fastenings.*"—December 2; six months.

George Saunders, of Hooknorton, Clerk, Oxford, and James Wilmot Newbery. of the same place, Farmer, for "*improvements in machinery for dibbling or setting wheat and other grain or seed.*"—December 2; six months.

Henry Trewhitt, of Newcastle-on-Tyne, Esq., for "*certain improvements in the fabrication of china and earthenware, and in the apparatus or machinery applicable thereto.*" Communicated by a foreigner residing abroad. December 4; six months.

Christopher Nickles, of York Road, Lambeth, Gentlemen, for "*improvements in propelling carriages.*" Communicated by a foreigner residing abroad.—December 4; six months.

Pierre Narcisse Cronier, of Fricourt's Hotel, Saint Martin's Lane, for "*improvements in filters, and in the means of cleansing the same, and for separating, colouring, and tanning matters for filteration, and for improvements in employing such tanning matters by filteration.*" Partly communicated by a foreigner residing abroad.—December 4; six months.

James Mayer, of Ashley Crescent, Saint Luke, Gentlemen, for "*an improved machine for cutting splints for matches.*"—December 4; six months.

George Lowe, Engineer to the Chartered Gas Company, and John Kirkham, Engineer to the Imperial Gas Company, both of London, for "*improvements in the manufacture of gas for purposes of illumination.*"—December 4; six months.

James Nasmyth, of Patricroft, near Manchester, Engineer, for "*certain improvements applicable to railway carriages.*"—December 4; six months.

John Heaton Hall, of Doncaster, Chemist, for "*improvements in preserving and rendering woollen, and other fabrics, and leather waterproof.*"—December 5; six months.

Harrold Potter, of Manchester, Esquire, for "*certain improvements in printing calicoes, muslins, and other fabrics.*"—December 9; six months.

Samuel White, of Charlton, Marshatts, Dorset, Esquire, for "*improvements in preventing persons from being drowned.*"—December 9; six months.

Moses Poole, of Lincoln's Inn, Gentleman, for "*improvements in the manufacture of caustic, soda, and carbonate of soda.*" Communicated by a foreigner residing abroad.—December 9; six months.

Thomas Richardson, of Newcastle, Chemist, for "*a preparation of sulphate of lead, applicable to some of the purposes for which carbonate of lead is now applied.*"—December 9; six months.

John Leslie, of Conduit Street, Hanover Square, Tailor, for "*improvements in measuring the human figure.*" Communicated by a foreigner residing abroad.—December 9; six months.

John Juckes, of Shropshire, Gentleman, for "*improvements in furnaces or fire-places for the better consuming of fuel.*"—December 9; six months.

Pierre Frederick Gongy, of Tavistock Street, Westminster, Watch Maker, for "*an improvement in clocks, watches, and other time-keepers.*"—December 11; six months.

Robert Hervey, of Manchester, Drysalter, for "*certain improvements in the mode of preparing and purifying alum, alumina, aluminous mordants, and other aluminous combinations and solutions, and the application of such improvements to the purposes of manufacture.*"—December 13; six months.

Robert Gill Ransom, of Ipswich, Paper Maker, and Samuel Millbourn, foreman to the said R. G. Ransom, for "*improvements in the manufacture of paper.*"—December 13; six months.

Angier March Perkins, of Great Coram Street, Civil Engineer, for "*improvements in apparatus for transmitting heat by circulating water.*"—December 13; six months.

Jacob Brazill, Governor of Trinity Ground, Deptford, for "*improvements in obtaining motive power.*"—December 16; six months.

Henry Seymour Moore Vandeleur, of Kilrush, Ireland, for "*improvements in paving or covering roads, and other ways.*"—December 16; six months.

Samuel Walton Faxton, of Park Village East, Regent's Park, Surgeon for "*an apparatus to be applied to the chimneys of gas and other burners, or lamps to improve combustion.*"—December 16; six months.

Monnin Japy, and Constant Jouffroy Dumery, of George Yard, Lombard Street, Gentlemen, for "*improvements in rotatory engines, to be actuated by steam or water.*"—December 16; six months.

David Morison, of Wilson Street, Finsbury, Ink Maker, for "*improvements in printing.*"—December 16; six months.

David Naylor. of Copley Mill, Halifax, Manufacturer, and John Crighton, Junior, of Manchester, Machine Maker, for "*certain improvements in machinery for weaving single, double, and treble cloths, by hand or power.*"—December 16; six months.

George Wilson, of Salford, Machinist and Engineer, for "*certain improvements in steam-whistles adapted for locomotive engines and boilers, and other purposes.*"—December 16; six months.

John Robinson, of North Shields, Engineer, for "*an improved steering apparatus.*"—December 16; six months.

John Wood, of Burslem, Stafford, Manufacturer of Mineral Colours, for "*a new method or process in the application and laying on of the substances used in the printing, colouring, tinting, and ornamenting of china, porcelain, earthenware, and other wares of the same description, by which such wares can be printed and ornamented with flowers and other devices in a much cheaper and more simple and expeditious manner than by any process now in use, and colours of all or any variety may be printed, shaded, mixed, and blended together in one of and the same design or pattern, and hardened or burnt into the substance of the aforesaid wares by a single process of firing or hardening in the enameling kiln.*"—December 16; two months.

James William Thompson, of Turnstile Alley, Long Acre, Upholsterer, for "*improvements in the construction of bedsteads, which improvements are particularly applicable to the use of invalids.*"—December 16; six months.

William Newman, of Birmingham, Brass Founder, for "*certain improved mechanism for roller blinds, which it is intended to denominate Simcox and Company's patent blind furniture.*"—December 16; six months.

Joseph Gibbs, of Kennington, Surrey, Engineer, for "*an improvement or improvements in the machinery for preparing fibrous substances for spinning and in the mode of spinning certain fibrous substances.*"—December 21; six months.

George Lindsay Young, of Hackney, in the county of Middlesex, Gentleman, for "*an improved surface for paper, mill or card board, vellum and parchment.*"—December 21; six months.

Henry Francis Richardson, of Ironmonger Lane, Gentleman, for "*improvements in omnibuses.*"—December 21; six months.

John Cutts, of Manchester, Machine Maker, and Thomas Spencer, of the same place, Mechanic, for "*certain improvements in the machinery or apparatus for making wire cards for carding cotton, silk, wool, and other fibrous substances.*"—December 21; six months.

Laurence Wood Fletcher, of Chorlton-upon-Medlock, Manchester, Machinist, for "*an improvement or improvements in the manufacture of woollen and other cloths, fabrics, and in the application of such cloths or fabrics to various useful purposes.*"—December 23; six months.

Thomas Firmstone, of Newcastle, Coal Master, for "*improvements in the manufacture of salt.*"—December 24; six months.

Alexander Mac'Rae, of the London Coffee House, Ludgate Hill, London, for "*improvements in machinery for ploughing, harrowing and other agricultural purposes, to be worked by steam or other power.*"—December 24; six months.

Thomas Hardeman Clarke, of Birmingham, Cabinet Maker, for "*certain improved fastenings for window sashes, tables, and such like purposes.*"—December 24; six months.

TO CORRESPONDENTS.

R. H.—*The Marquis of Tweeddale's brick and tile-making machine is patented, and licences are granted for using it in various parts of the kingdom.*

The communication of M. N. O. *will appear next month.*

A Catholic must excuse us for not publishing his last communication.

The Epycycloidal Motion for a Steam Engine is not new.

A lithographic drawing of a Church was received from Norwich by our publisher, but unfortunately it has been mislaid, we were charged 2s. 8d. for carriage and porterage for it, we trust that our correspondent will not in future put us to that expence.

We have been obliged to postpone some important Engravings, which we could not get ready in time, until next month.

Communications are requested to be addressed to "The Editor of the Civil Engineer and Architect's Journal," *No.* 11, *Parliament Street, Westminster, or to Mr. Groombridge, Panyer Alley, Paternoster Row; if by post, to be directed to the former place; if by parcel, to be directed to the nearest of the two places where the coach arrives at in London, as we are frequently put to the expence of one or two shillings for the* porterage only, *of a very small parcel.*

Books for review must be sent early in the month, communications on or before the 20th (if with wood-cuts, earlier), and advertisements on or before the 25th instant.

The First Volume may be had, bound in cloth and lettered in gold Price 17*s*.

*** The Second Volume may also be had, Price 20*s*.

Plate, 1.

Harvey & West's Patent Pump Valve.

Fig. 1.

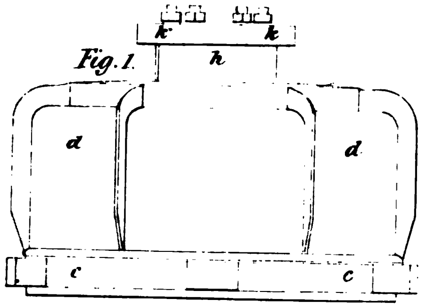


Fig. 2

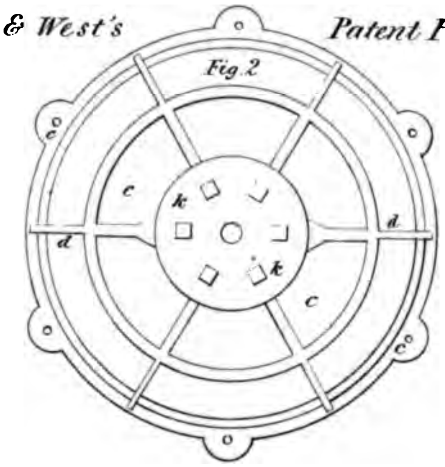


Fig. 3.

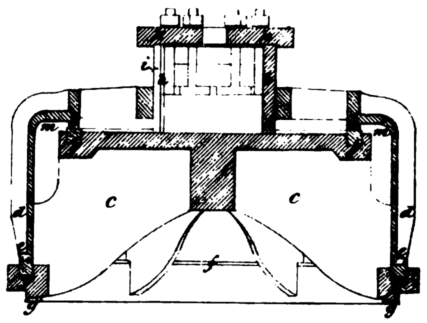


Fig. 4.

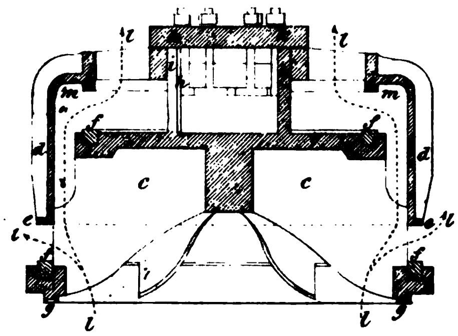


Fig. 5.

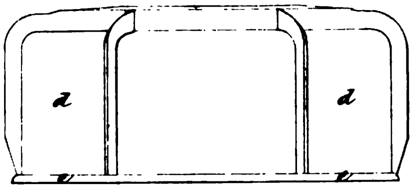


Fig. 6

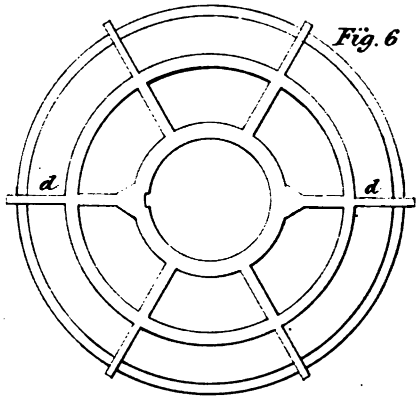


Fig. 7.

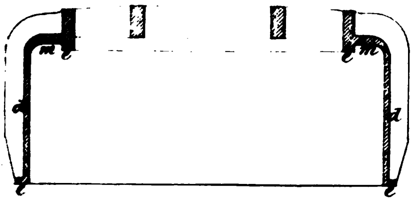


Fig. 8.

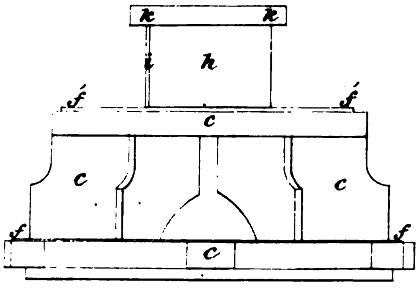


Fig. 9.

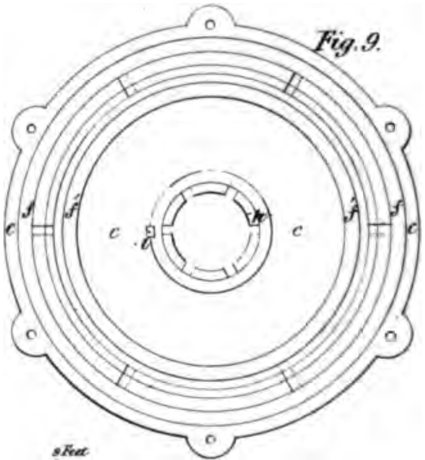


Fig. 10.

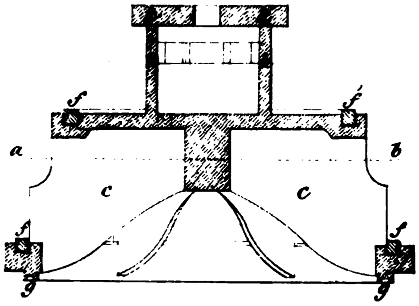
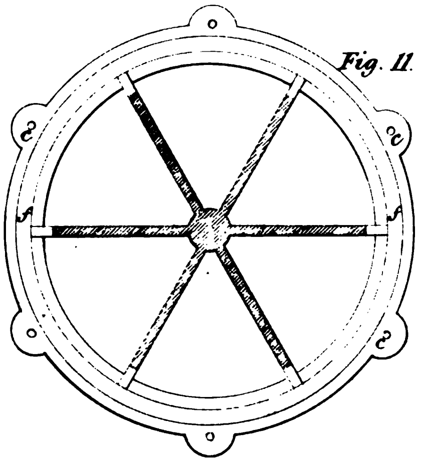


Fig. 11.



J. R. Jobbins. Warwick Court

HARVEY AND WEST'S PATENT IMPROVED VALVE *for Machines for Raising Water and other Liquids.*

SPECIFICATION.

Now know ye, that our improved valve resembles, in appearance, a valve known by the name of the "double beat valve," used in certain steam engines; our improvement consists in making the same self-acting, so that it can work without the aid of machinery for opening and shutting it, and thereby is applicable to machines for raising water and other liquids.

In our improved valves the area of the upper part of the seat, on which the top of the valve beats, is made less than the area of the lower part of the seat, on which the bottom of the valve beats, the valve being made of course to correspond, and the difference in area between the two must be such that, when the valve is used in the place of the lower valve in a pump through which the water passes into the pump barrel, the pressure of the atmosphere upon the under side of the valve (brought into action by creating a partial vacuum upon the upper side of the valve when motion is given to the piston, bucket, or plunger-pole of the pump,) shall be sufficient to overcome the weight of the valve, and cause it to rise, and when the valve is used in place of the upper valve, through which the water is forced out of the pump barrel, or when used in lieu of the valves upon the pump bucket, the difference in area must be such that the pressure upon the under side of the valve, (caused by the motion of the piston, bucket, or plunger-pole forcing the liquid through it,) shall be sufficient to overcome the weight of the valve, and cause it to rise; the opening in the top will be less than the opening in the bottom of the valve, and the surface of the ring upon the top of the valve, which will be equal to the difference between the area of the two openings, must be made proportionate to the weight of the valve itself, the action will be more fully understood by reference to the drawings and explanation thereof hereinafter given.

The advantages to be obtained by the use of our improved valve, are 1st, That as the area of the valve exposed to the pressure of the column of water, or action of the piston upon its return stroke, is considerably less than in the ordinary circular, hanging or butterfly valves, the blow and consequent vibration caused by the shutting of the valves, is considerably diminished, and less costly foundations are therefore required. 2d. The loss of water upon the shutting down of the valve is considerably diminished. Our improved valves may be used for the upper and lower valves of all varieties of pumps.

In order to explain more clearly the construction and action of our improved valve, we will now refer to and describe the drawings, representing plans, elevations, and sections of it. The same letters of reference are marked upon all the figures.

Figure 1 is an elevation of the valve and its seat, the valve being shut. Figure 2, a top view thereof, the valve being open or shut. Figure 3, a vertical section through the valve and seat, the valve being shut. Figure 4, a vertical section through the valve and seat, the valve being open. Figure 5, an elevation. Figure 6, a plan. Figure 7, a vertical section of the valve detached from its seat. Figure 8, an elevation. Figure 9, a plan. Figure 10, a vertical section of the seat. Figure 11, a horizontal section of the ribs through the line *a b*, in fig. 10, and plan of the bottom or lower beat; *c c c c* the seat made of cast iron or other metal, upon which the valve *d d* works. The valve may be made of cast or wrought iron, gun-metal, brass, copper, or other metal, according to the size, the quality of the water, or other circumstances. The rings *e′ e′ e e* are faced, that is are turned true, and when shut, fit accurately to the beats *f′ f′* and *f f* upon the seat *c′ c c c*; *f f* is the lower beat, and *f′ f′* is the upper beat. In fig. 7 *e′ e′* is the top opening of the valve, and *e e* the bottom; the beats may either be formed by a raised ridge cast, or wrought upon the seat, and faced or turned true, or by introducing into circular grooves, cast in the seat, a ring of wooden wedges, or of soft metal; the top surface in either case to be faced or turned true, to receive the valve—we prefer wood or soft metal; *g g* represents a circular groove cast or wrought, on the under side of the seat, into which leather is introduced, so as to prevent leakage when the seat is bolted down in its place. *h h* is a cylinder cast upon the seat and turned true, so as to form a guide for the valve to work upon, and to keep it in its right place. *i i* is a metallic feather attached to the cylinder, and projecting into a groove formed in the valve, to prevent any circular motion in the valve; and *k k* is a cap bolted upon the cylinder to prevent the valve rising beyond a given height, or being displaced. The dotted lines *l l l*, *l l l*, fig. 4, represent the direction that the water takes when the valve is opened. *m m* represent the surface of the valve that is exposed to the pressure of the atmosphere, or force created by the motion of the piston, and which when proportioned as hereinbefore described, by making the difference in area between the space by the rings circumscribing the top and bottom openings of the valve, sufficiently great to allow the force applied to overcome the weight of the valve, will cause it to rise.

Having now described our improved valve, and in doing so, having also described certain contrivance and constructions, which we do not claim as our improvement, but the description of which was necessary to elucidate our improvement; we hereby declare that we claim as our improvement that part of the contrivance only which makes the valve self-acting, by making the area of the top opening of the valve less than the bottom, and making the seat to correspond thereto, which area must be varied according to the size and weight of the valve, and must be proportioned thereto.

IRON TIES THROUGH PARTY WALLS.

Experiments tried at Chatham on the 6th of December 1839, in respect to iron ties passing through party walls to form a continued bond for the floors of adjacent houses.

In the course of practical architecture taught to the junior officers of the Royal Engineers of Chatham, the floors of two adjoining houses are connected by ties, each consisting of a strap of iron passing through a party wall, and bolted to the sides of two girders, in the same allinement, which sort of tie-bond may be supposed to be continued through the whole extent of a range of barracks, or of a row of houses, as was done by Messrs. Baker in their new houses on the north side of the Strand, near Exeter Hall.

The utility of this sort of continued bond could scarcely be doubted, but a query having often suggested itself, whether the destruction of the floors of one house by fire, might not heat the iron-ties passing through the party walls, on each side, so far as to endanger the floors of the two adjacent houses; Colonel Pasley directed Captain Williams to try the following experiment, which must be considered conclusive.

In the accompanying figures, *w* is a 9 inch brick wall, 6 courses high, representing a portion of a party wall between two adjoining houses. For the convenience of applying the fire, it was built upon the hearth of a smith's forge. The 4 inch wall *e*, *e*, were added merely to enclose the fuel, and to increase its heat. These walls were built the day previous to that on which the experiment was made; and as common lime mortar would have required considerable time to dry, cement

Fig. 1, Plan.

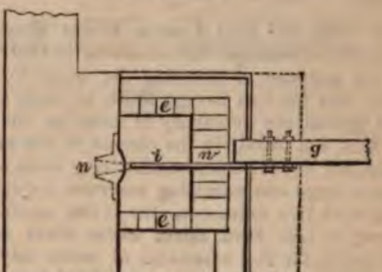
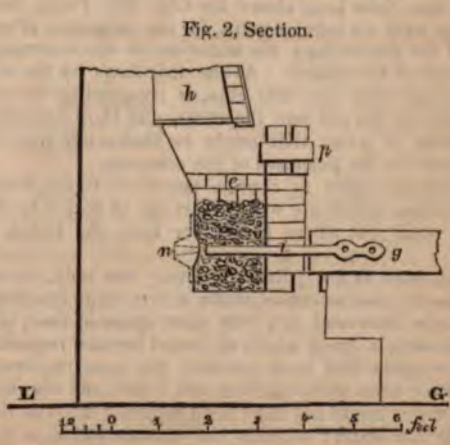


Fig. 2, Section.



p six pigs of iron ballast, each 56 lbs. to prevent the brickwork separating by the heat. *h* Hood. G. L. Ground Line.

mixed with sand was used instead of lime; *g* is a piece of Memel timber, 3 feet long, 6 inches wide, and 11 inches deep, representing part of a girder, having an interval of one inch between the end of it and the party wall; *i* is the iron strap, 3½ feet long, 2½ inches wide, and ½ inch thick, bolted to the girder *g*, and passing through, and extending beyond the wall to within one inch of the nozzle *n*, of the tew iron of the bellows. One foot four inches of its length was exposed to the fire, which was lighted at ten o'clock A.M.

By eleven o'clock the fire was in good action throughout; the coals were well heaped over and about the iron strap to within 5 or 6 inches of the top of the wall, and the heat was kept up to the greatest practicable intensity, by the uninterrupted action of the bellows, till four o'clock P.M.

It was one o'clock before that part of the iron strap in contact with the girder became too warm, even close to the wall, to render it necessary to withdraw the hand from it, and even at four o'clock, by which time 5 inches of the end nearest the tew iron were burnt completely away, there was not sufficient heat in any part of it outside the party wall, either to discolour dry wood shavings or paper, or to ignite maptha. At 6 inches from the wall the hand could be continued on the iron without inconvenience during the whole period the experiment occupied, and at no time was the party wall red hot.

There can be no doubt but that the fire might have been kept up long enough to consume the whole of the iron surrounded by it, without sufficient heat being communicated to the girder to set fire to it.

The bulb of a thermometer that happened to be at hand, was applied to the iron, where it entered the party wall, but the degree of heat could not be determined, as the tube extending only to 118 degrees of Fahrenheit, was very soon filled by the quicksilver, and was then withdrawn to prevent it from bursting.

The cement mortar in the joints of the brickwork nearest to the fire was reduced to dust. In this state, Colonel Pasley ordered some balls of it to be mixed up with water, into the consistency of a stiffish paste, which set rather slowly, but in the course of a few days became extremely hard, in consequence of the cement having been calcined by the fire, and thereby restored to the same state, in which it had been received from the manufacturer.

BALANCE GATES.

Erected at the Works of the East London Water Works Company, Old Ford. Engineer, Thomas Wicksteed, Esq., M. Inst. C.E. *With two Engravings, Plates* II. & III.

In the year 1833, the East London Water Works Company made very considerable alterations and additions to their works, by cutting a canal for the purpose of bringing the water from a higher part of the river Lea, near the Lea Bridge Mills, to their works at Old Ford, and to guard against any deficiency of water for the working the mills on the river Lea, and to satisfy the owners of the mills, the Company agreed, in the Act of Parliament authorizing them to make the alterations, to form a large compensating reservoir covering about 14 to 15 acres of land, with two entrances, one at the south-east corner of the reservoir, near to Old Ford Lock, where there is erected a pair of tide or flood-gates, for the *admission* of water only as the tide rises, and another entrance at the eastern corner of the said reservoir upon the banks of the river Lea, above the City Mill Point, consisting of three openings with six balance gates, for the *admission* of water from the river, and for *discharging* the water out of the reservoir into the river for the use of the millers. As the tide flows up the river it fills the reservoir, and when the tide ebbs, if required by the millers, the water is allowed to run out into the river, and thus compensate them for any quantity of water that might be abstracted from the upper part of the river for the purposes of the company.

It is our present object to confine ourselves to the description of the Balance Gates, which are well deserving of notice by the profession, and to point out where they differ from the Dutch system of construction.

As the neap tides at the point of delivery rise only, on some occasions, a few inches, and as consequently a very large quantity of water might have to be delivered in a very short space of time, with so low a head or pressure, a great width of outlet became requisite; if the ordinary sluice gates had been erected, the time required to open them would have been above an hour and a half, and consequently the whole of the water might not have been returned into the river before the preceding low water; whereas the balance gates, as we can bear witness to, are easily opened or closed in ten minutes, *against* a pressure of water.

The essential difference between the gates designed by Mr. Wicksteed, and the old Dutch balance gates as described in Belidor's Architecture Hydraulique, is this—the old gate is larger in area on one side of the centre than the other, on the largest side a sluice gate is introduced, which when opened reduces the area of the largest side, so that it becomes less than the other, which was before the sluice was opened, largest; by this arrangement when the sluice gate is shut the pressure of the water upon the largest area causes the gate to remain closed, but when the sluice is opened the greatest pressure is upon the other side (or *half*) of the gate, and causes it to open *but not completely*, and tackle must be made to open it *wide*. In Mr. Wicksteed's gates the sides are of equal area, and they are made to open at once by a toothed quadrant and pinion; two gates are also introduced in each opening, and set at an angle which gives strength to their construction and saves masonry. When the gates are closed, by the application of a very ingenious contrivance, consisting of a vertical iron shaft fixed in the hollow quoins, with three eccentrics or cams upon it, they are made to close against each other, and against the cills and recesses in the side walls, so that no leakage whatever takes place.

These gates are, we believe, the only ones of the kind erected in the kingdom, and when we were favoured with a view of them, they had been in use for six years and in excellent working order, they had not been repaired since they were first erected by Messrs. Hunter and English, of Bow, whose reputation as millwrights is so well known, that they needed not this accession to their fame.

The cost of the gates we could not ascertain, as they were done in conjunction with other works by contract, but we can easily give credit to Mr. Wicksteed's statement that the expence was not more, if so much, as common sluice gates with their elevating machinery, foundation, &c., when it is considered how many sluices there must have been to insure the same width of opening.

These gates are different in construction, and are used for a different purpose to those erected some years since at Lowestoff; with the exception of these two instances, we are not aware of any other gates erected upon the Dutch principle in England, but we think there are many cases in engineering where their introduction might be advantageous.

The following additional particulars we select from the contract and specification of the work, which will together with the engravings give an accurate view of their construction.

" They (the Balance Gates) are different in construction to the common flood-gates; a description of one gate will answer for the whole: the gate is made to work upon a vertical shaft as a centre, and is equal on each side thereof. One gate, when closed, shuts against another gate on one side, while the opposite sides close against a recess in the piers or side walls. It will appear evident, upon an inspection of the plans, that the gates being equal on each side of the vertical shaft, which is the centre of motion, whatever pressure of water may be against them, that there is as great a tendency to keep the gate closed as there is to open it, and that being, under any circumstances, equally balanced, a very slight exertion of power (sufficient to overcome the friction of the working parts) will either open or close them. When the gates are closed, and it is desirable to retain the water in the reservoir, to destroy the effect that any vibration might have upon them to cause a leakage, a shaft is introduced upon which three eccentrics are cast, which, when applied to the gates, pinches them against their abutments, and thus prevents any leakage that might by possibility occur. When it is desired to open the gates to discharge the water of the reservoir into the river, the eccentric is first to be worked so as to take off its effect upon the gate, and then the quadrant and pinion must be worked to open the gate, which, as the pressure of water is equal in its action upon both sides of the centre, will be a matter requiring but a small exertion of power.

Description of the Work.—The framing of the balance gates is to be of good English oak timber; the planking to be the best Memel plank. All the joints are to be made sound and good; the mortices to be cut out square their whole depth, and the tenons to be made so that they shall fit equally over every surface; the butting joints to be squared so as to touch and bear equally over the butting surface. Wherever the timbers are framed into the iron-work, the iron-work shall be made true and good to receive it, so that it shall bear equally on all the surfaces; and wherever wrought iron straps are let into the timbers, they shall be fitted accurately; no packing will be permitted, but the iron must fit fairly and strictly to the wood. All keys and bolts for straps, and cast iron work must be made to fit accurately, so that the bolts fill up the holes made for their reception, without shaking or depending, upon the friction of the head aud nut.

The timbers are to be rebated for the reception of the ends of the 2-inch fir planking, so that when the planking is introduced, the surfaces of the planking and timbers shall be flush—the planks are to be 2 inches thick and 9 inches wide, to be laid diagonally, as described in the drawings; at the two ends, and wherever there is a cross or diagonal timber, the plank shall be fastened thereunto by means of 2 screw bolts at every bearing, and wherever iron intervenes between the planking and timber, it shall be drilled, and the

EAST LONDON WATER WORKS.

Plan of the Wooden Bridge.

Fig. 5

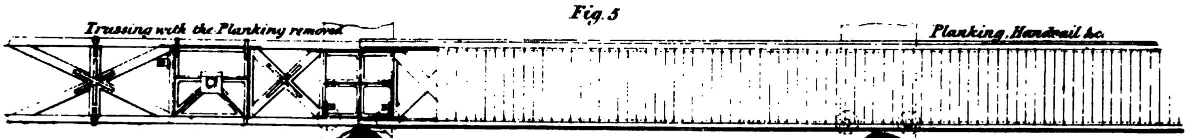
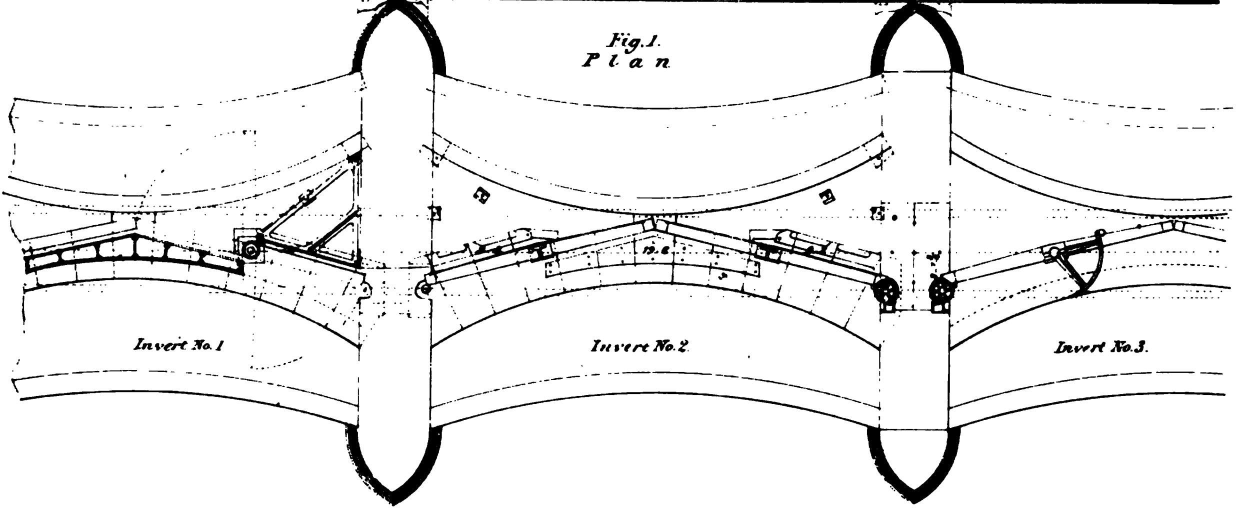


Fig. 1.
Plan



Balance Gates.
Entrance to Compensation Reservoir.
Front Elevation
Fig. 2.

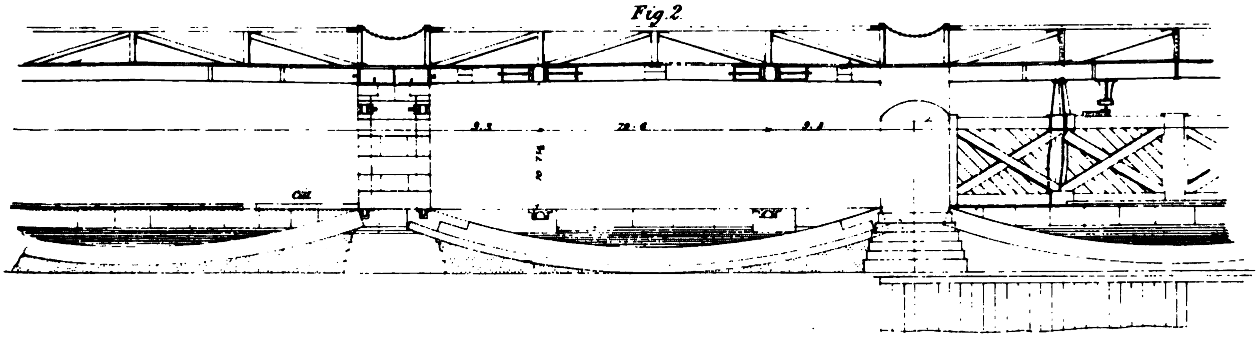


Fig. 3.
Transverse Section through C. D.

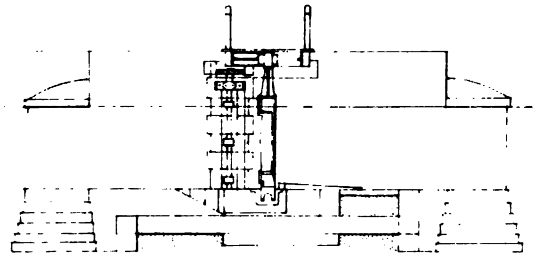
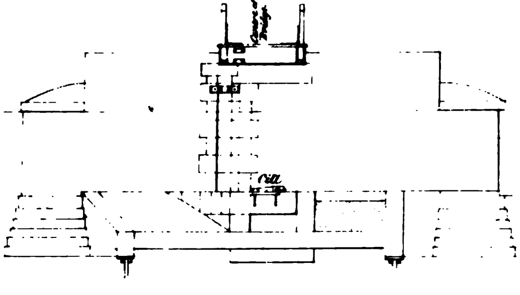
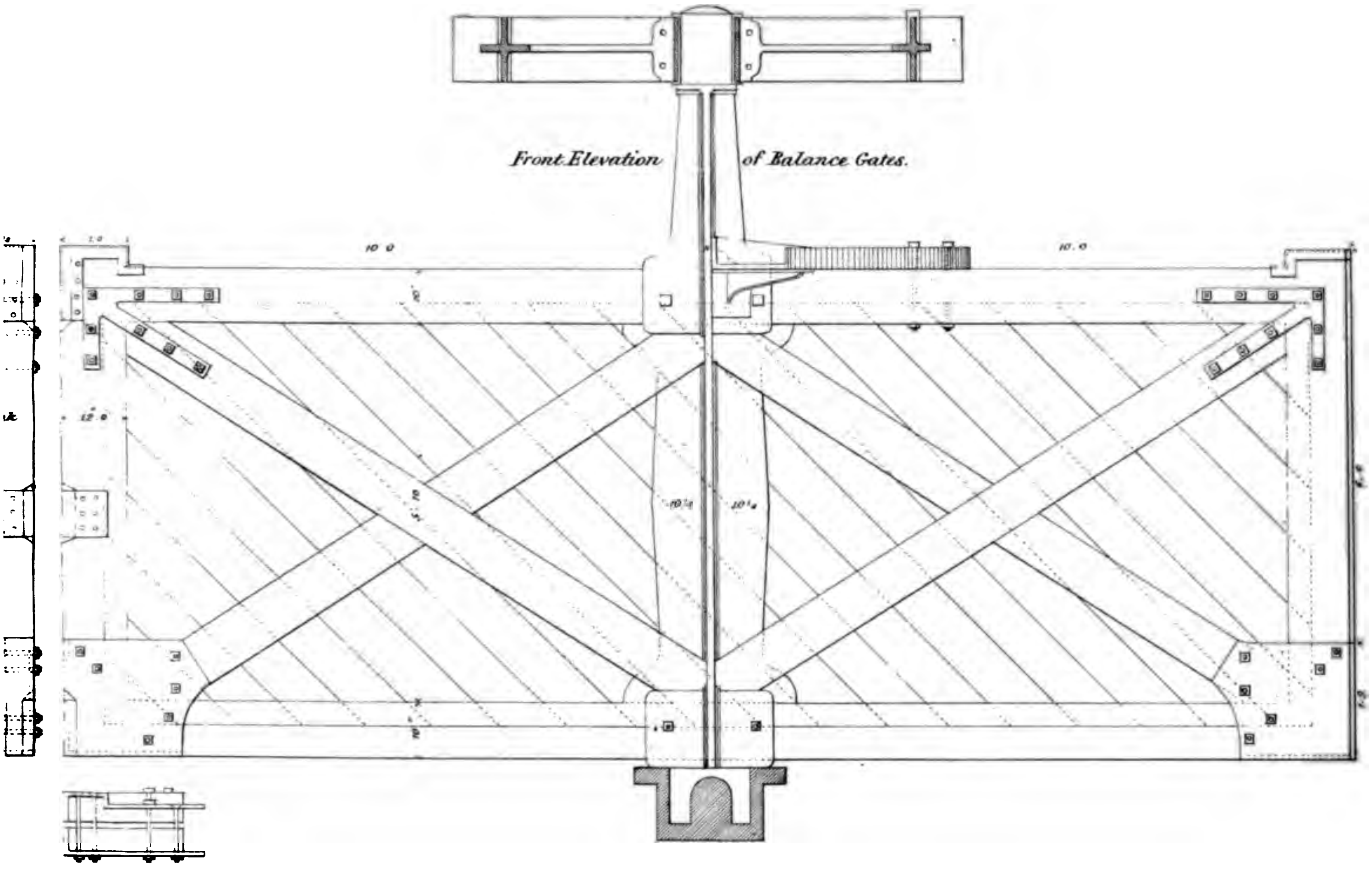


Fig. 4.
Transverse Section through A. B.

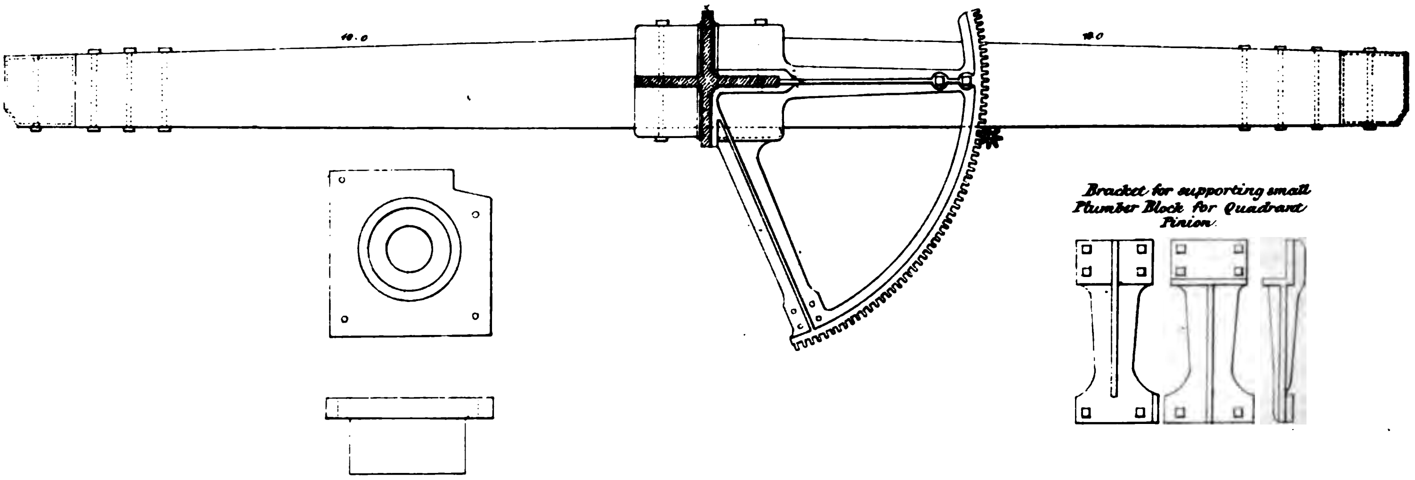


ons, Warwick Court.

Front Elevation of Balance Gates.

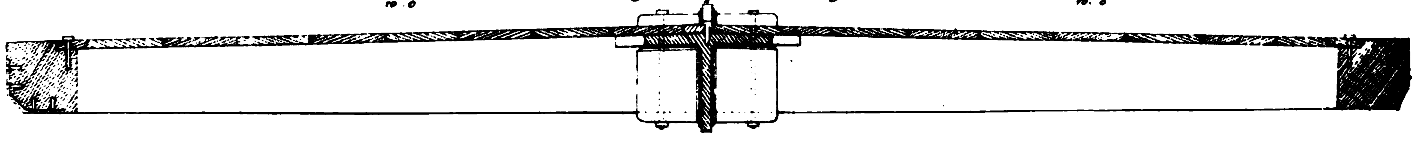


Top View of Gate.

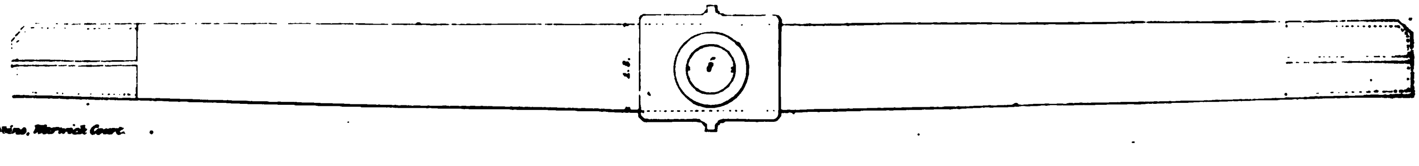


Bracket for supporting small Plumber Block for Quadrant Pinion.

Horizontal Section through Gate.



Plan of Bottom of Gate.



J. R. Jobbins, Warwick Court.

bolt shall fit accurately, iron to iron—the screw bolts are to be 5-8ths of an inch diameter, and 5 inches long, with square heads, and a neat iron collar under each head and nut, excepting where iron intervenes, when the bolt shall be as much longer as the thickness of the iron, so that every bolt shall have a screw of 3 inches deep in the timber. The joints of the planking shall be shot straight, fitted close, and caulked, so as to render every joint perfectly water-tight.

The pivots on which the gates revolve are to be cast hard, and fitted accurately to the hollow bearing in the vertical shaft.

The gates are to be made accurately at the meeting posts. At the sides which abut against the piers and walls, and at the cills and wherever iron intervenes, it shall be chipped and filed so as to fit flush with the timber, so that no water shall escape at the joints—the pivot and step are to be so made that the least possible leakage shall take place.

All the cast iron bearings are to be accurately turned, so as to work truly and easily, and in every case where iron works in iron, *either* the shaft *or* bearing is to be cast hard, as may be deemed advisable by the Company's engineer—the upper bearings to have set screws and keys for adjustment, as described in the drawings. All the wheel work is to be fitted accurately, and if required by the Company's engineer, the teeth are to be chipped and filed.

The same directions that are given hereinbefore for the joints in the timber and connecting straps and bolts, are to be observed in the construction of the trussed foot-bridge, which is to be wholly of the best Memel fir.

REFERENCE TO ENGRAVINGS.—PLATE II.

Fig. 1.—Plan of the Balance Gates, Sills, Inverts, and Piers. In "Invert No. 1," the sill pieces are shown, and the iron pivots upon which the gates are to turn. In "Invert No. 2," the gates are shown at an horizontal section through the timbers and planking, and vertical shaft; the eccentric shafts are also shown. In "Invert No. 3," the top view of the gates is exhibited with the quadrant and pinion for working the gates, and the wheel upon the top of the eccentric shaft.

Fig. 2 is an elevation of the work described in Fig. 1. The gates, however, are shewn in *projection*, or as they will appear when closed; the trussed foot-bridge for the support of the upper bearings of the shafts upon which the gates turn, is also shown in elevation and section.

Fig. 3.—A transverse section through C D (Fig. 1) of the gate and trussed foot-bridge, and an elevation of one of the piers and section of the invert, sill, and apron.

Fig. 4.—Transverse section through A B (Fig. 1).

Fig. 5 is a plan of the trussed foot-bridge, a portion of it planked as it will appear when finished, and another portion as it will appear before the planking is laid down, exhibiting the trussing and cast iron frames for the support of the upper bearing of the vertical shafts.

PLATE III—contains enlarged views of the gates described in Plate II, which may be sufficiently understood by reference to the drawings.

LONDON SHOPS.

[A very able and interesting article on "London Shops and Gin Palaces," by Candidus, appeared in the December Number of *Fraser's Magazine*, from which we select the following extracts.]

We need not speak of the very superior mode in which shop-windows are now fitted up, not merely as regards the large squares of glass, and the more than atlas folio sheets of plate-glass, which have of late become almost so common as to cease to excite astonishment, but also in respect to the framework of the windows, the polished brass-work which covers the window-sill. One contrivance, however, which has been but very lately introduced, will, when it comes to be more generally adopted, greatly enhance the appearance of the shops after dark,—we mean that of throwing a very powerful light upon the goods at the window, the first experiment of which was made, we believe, on the east side of Temple Bar, viz. at the splendid new shop opened in St. Paul's Churchyard by Hitchcock and Rogers; which, in point of extent, has scarcely a rival in any other part of the town. The proprietors appear to have spared no cost to render their establishment as attractive as possible even to the very labels or tickets attached to the goods, which, instead of being merely written, are tastefully emblazoned on large card-boards, in gold, azure, and other brilliant colours. Still, when we come to consider this, and some other shop fronts of the same class, architecturally, we cannot help being offended at a defect which is here carried *à l'outrance*, to a much greater degree than any where else. In fact, the whole of this unusually extensive shop front presents to the eye nothing but glass set in very slender upright brass styles, or bars, without any apparent support whatever — without even jambs to the doors — so that the house itself, over the shop, has the look of being miraculously suspended in the air, after the fashion of Mahomet's coffin; and this not particularly agreeable appearance is strikingly increased by its returning on the west side, without any indication of prop or stay of any kind beneath the superincumbent angle of the upper part of the structure, which is actually suspended over that corner. There is no doubt that sufficient precaution has been taken to ensure security; and so far we are at liberty to admire the skill shewn by the builder in achieving what is certainly a *monsterpiece*, if not a masterpiece, in construction. His task may have been exceedingly difficult; yet we are tempted to say, with Dr. Johnson, that we wish it had been impossible. It will, perhaps, be argued, that what we here behold is, after all, not a whit more contrary to sound architectural taste than a geometrical staircase, where the steps are attached to the wall only at one end. The two cases, however, are not perfectly similar; because, in the second instance, each step is no more than either a balcony or large bracket inserted into the wall, whereas, in the other, the bressumers of the floor, above the shop, have to support all the upper part of the front, while they themselves seem to rest upon nothing except the slight frame in which the glass of the shop window is fixed. As far, therefore, as the general aspect of such front is concerned, the effect is disagreeable; while, as regards the lower part, or shop itself, taken distinct from the rest, it is exceedingly insipid and poor—very little better than what would be produced by the same space of unglazed opening for the display of goods; the chief difference being, that instead of being exposed to injury, the articles so exhibited are protected by the glass.

No doubt, every tradesman is anxious to make as attractive a display as possible of the articles he deals in; but it is, nevertheless, a great error to suppose that this is best accomplished by making the shop-window as large as the width of frontage will permit, and then to put up at it as much as it will contain. In fact, this mode—the one now almost invariably resorted to, and in many cases carried to an extent quite preposterous—rather defeats the object aimed at, because it utterly excludes all variety of design, or rather excludes design itself—reducing the whole front of each shop to only so many feet superficial of glass. Hence there is nothing to distinguish any one shop from the rest—nothing to mark it out to the eye from any distance. If strikingness of character be at all an object worth attending to, it might be far more easily and more satisfactorily accomplished by adopting a contrary system to that now in vogue, dividing what is now a single window into distinct compartments, the spaces between which would afford room for decoration, together with ample scope for invention. It is true that, as far as mere quantity goes, the display would be less than at present; but then the show of goods might frequently be rendered more striking, and might be every day made a fresh one, by some of the articles being changed. The great desideratum, it may be presumed, is to render the shop itself a conspicuous object—one that cannot fail to arrest the attention of every one who passes; and this, we conceive, would, in most cases, be better accomplished by making it a catching architectural "frontispiece"—no matter how much the space now allotted to a window might be trenched upon for such purpose.

* *

Even at present we have one or two things, which, although they do not exactly exemplify the mode of design we could wish to see adopted, may be quoted as instances of very superior taste, and withal, of more originality and study than are to be discovered in buildings of far greater importance. Among these, we do not hesitate to say that the *facile princeps* for *recherché* elegance of design, for purity of taste, for happiness of invention, in the whole composition, together with admirable beauty of finish, is a small shop front, or, rather, a small façade, in Tavistock Place. It is an exquisite architectural gem—at least every professional man and real connoisseur must at once recognize it as such—although its beauties and merits are of that kind which are not likely to ensure it particular attention from persons in general; because in such matters the million are apt to form their estimate according either to size or to gaudy showiness. No man who understands architecture can look at it without feeling that the worthy George Maddox here worked up his ideas *con amore*, with the relish of one enthusiastically devoted to his art for his art's sake. The whole of this front—for we ought to observe that the design is not confined to the lower part or shop alone—is in perfect keeping: we do not find merely a very good bit in this place, a very nice piece of ornament in another; something happy there, and something not amiss here, but the *ensemble* is complete; the same taste pervades every part: nothing can either be added or taken away without detriment to the whole. What simplicity in the general character of this little façade! yet so very far is it from partaking of any thing like poverty, that it is particularly remarkable for the unusual care bestowed upon all its details. Indeed, there are only one or two buildings in the whole metropolis that can stand the test of comparison with it in that respect. Examine the capitals and entablature of the order that forms the shop front itself, and you must allow them to be no less beautiful than novel, that is, supposing you are competent to appreciate the originality and taste there manifested. After all, it must be allowed to have one unpardonable fault: how great soever may be its merits in point of design, it wants magnitude—at least to give it sufficient consequence and importance in the eyes of ordinary beholders. Truly it does; and so, also, does that beautiful little architectural gem of antiquity, the monument of Lysicrates, which, in regard to size, is little better than a mere model, or toy. To be sure, the one example is at London, the other at Athens; and that, it must be acknowledged, does make a vast difference in the opinion of the vulgar, both learned and unlearned. Most certainly, there is no denying that Tavistock Place is not Athens, any more than that Saffron Hill is not Mount Hymettus.

The only thing that can fairly enter the lists with the façade we have been speaking of, is the one No. 22, Old Bond Street, which is likewise singularly beautiful, and treated throughout with true artistical feeling. It is the production of the Messrs. Inwood, or of one of the brothers, and it certainly displays more invention and taste than all their other designs put together, if we except the columns and doors in the portico of St. Pancras Church; the former of which, however, are merely copies from those of the triple temple on the Athenian Acropolis. These two are almost the only instances in which the whole of such a front is consistently designed and decorated throughout, so as to be altogether of a piece from bottom to top; for the shop and the house above it are, we may say, invariably treated as distinct from each other, instead of being combined, as far as their inevitable difference of character will permit, into one uniform composition. This is more or less the case, even where architectural embellishment is liberally bestowed on the upper part of the front, the superstructure having so little architectural connexion with the basement on which it stands, that the effect is quite incongruous. Of this we have notable proof in a shop in St. Paul's Churchyard, already spoken of; since, so far from there being an apparent connexion between one part and another, we might fancy that the upper portion, with its Corinthian pilasters, had been taken off from a rusticated basement, and suspended upon the huge glass case beneath it, which it threatens to crush. A greater architectural antithesis than the one thus produced can hardly be imagined, the whole of the lower portion presenting the very minimum of strength, an appearance of unusual weakness and fragility, while the upper has a more than usual character of solidity, owing, among other circumstances, to the breadth of the piers between the windows; that is, however, of solidity when it is considered apart from its baseless position, because that exceedingly false position gives it the appearance of being particularly insecure, and in imminent peril of performing an *aplomb*.

Perhaps, of the two inconsistencies, it is the lesser one where, as is almost the general rule, architectural expression is confined to the shop-front itself, all the rest being left quite unpretending and plain, even to nakedness. It must be admitted, that the other method is greatly preferable, as far as the general appearance of a street is concerned, inasmuch as it conduces to its architectural dignity; yet, as regards the houses individually, it is better that the shop-front itself should be made exclusively the feature on which architectural design is bestowed, unless, indeed, it can be consistently carried on upwards.

Although frequently no other economy than that of space seems to be regarded, it cannot be affirmed that much either of invention or taste is displayed in our London shop-fronts, of which carpenters seem, for the most part, to be the designers; yet here and there one may meet with a clever bit,—good both in regard to ornament and composition. These, however, form merely the exceptions; for the taste usually displayed is most flimsy and frippery, and full of inconsistencies. At the best, things of this kind can be little more than mere bits; because, owing to their want of size, they can hardly produce any effect in a general view, or until approached and examined; yet that is no reason wherefore they should be undeserving of examination, and bits of tawdry trumpery in themselves. On the contrary, if they do not afford much latitude for the display of design and invention in any other respect—an opinion, however, to which we ourselves are strongly opposed—they most incontestably offer ample scope for experimentalising in the way of columns and entablatures. Nevertheless, so far from any advantage being taken of this, we scarcely ever find any novelty whatever of decoration attempted in regard to such features, which are no other than copies from Stuart's plates. However anti-classical, gimcrack, Cockney, every other part of such design may be, we behold Grecian Doric and Grecian Ionic copied with most superstitious exactness, and repeated *usque ad nauseam*. The Athenian Doric of the Parthenon, and the Pæstan example of the same order, are most ridiculously *minified*, and applied when they are most offensively out of place, putting us out of conceit both with them and with what but for them would have been honest, unsophisticated, Cockney carpenters' work. Away with the worse than schoolboy—the dull schoolmaster vapouring, about the intrinsic beauty of form and proportions belonging to the ancient orders, as if they possessed an indefeasible charm adhering to them under any circumstances. At that rate, it would be excellent taste to convert the legs of a table into four pigmy columns, Doric or Ionic; or if the mere models of such things possess in themselves a magic charm for the eye, neither could they fail to please were they dragged in any where else for the nonce, even should it be into a Gothic building. The truth is, no such kind of beauty exists either in them or any thing else: a fine arm and hand are very beautiful in a fine woman, or, for the matter of that, even in a plain one; yet how they could be made to add to the beauty of a horse, we certainly do not see. Of all the styles, the one least suitable for purposes which require it to abandon more or less of its original character, is the Grecian Doric, whose sternness and severity, apart from the imposing grandeur attending magnitude of dimensions, are apt to degenerate into frigidity and hardness when the order is exhibited upon a trivial scale. Instead of attempting to counteract this defect, which predominates in most modern imitations of that style, we increase it by omitting all sculpture and other decoration, as not included in the idea of the architecture itself, although it is essentially indispensable to its effect. By the chilling bareness thus occasioned, a style naturally stern in itself becomes aggravated into disagreeable harshness; more particularly when reduced to more than ordinary insignificance of size; for all dignity of expression is lost, and in lieu of it we obtain poverty of style, with an affected heaviness of form,—something nearly as grotesque as a little Cupid proportioned after the brawny form of the Farnese Hercules.

Yet such is the style upon which, at least, one-half of our modern shop-fronts are modelled. As far as the columns alone go, they are tolerably accurate, and intolerably dull fac-similes of the different examples measured by Stuart and others; but there all resemblance ends. The frieze—should there happen to be any such member in the entablature—is as plain as the architrave; nevertheless, such disregard of authorities is a trivial fault, in comparison with the wholesale disregard of the genius of the style itself. Yet so it is: over-exactness as to certain particulars goes hand in hand with the most fantastical licentiousness—if that can be called fantastical which manifests not the slightest aim at fancy. It is, however, not so much the deviation from precedent that we censure in such cases, as the awkward and absurd adherence to it, or rather the affectation of adhering to what it is impossible to follow consistently as a model. Even supposing that, in regard to the architecture itself, the style could be sufficiently well kept up, still it would very ill assort with the display which it is intended to accompany. Fancy goods and Pæstan columns—plumes, velvets, artificial flowers, and Doric pillars—do not harmonise well together, nor seem to be suitable company for each other. A striking instance of such disparity between the richness of the stock it contains and the shop itself is Holmes's shawl warehouse, in Regent Street; where, notwithstanding the splendour of the *coup d'œil* of its interior, the exceedingly massive, not to say rude, Doric columns supporting the ceiling look most uncouthly lumpish amidst all the costly finery around them. Surely, a lighter style would have been far more in character; or, if pillars of that bulk were absolutely required, they might easily have been enriched. It is true, they might then have lost all resemblance to Doric columns; yet of what consequence would that have been, or rather it would have been so much the better, supposing them to be appropriate and pleasing in themselves—that is, successful inventions; and if we dare not venture upon any experiments in architectural design on such occasions, we are not likely ever to make them, when the question is to erect a building of magnitude, where every thing is expected to be perfectly *secundem artem*, and where, of course, nothing can be admitted that might possibly be sneered at as a rash innovation—a startling new idea.

Perhaps it would be some step towards improvement, were such style of design adopted for the decoration of shops as would in a certain degree accord with the stock itself and the particular business carried on. Attention to congruity of this sort would, doubtless, have suggested for the one just referred to above, a style altogether different from what we actually behold—something light, fanciful, luxuriant; and, if not professedly in the Oriental taste, that is, after an express pattern of it, yet more or less approaching to it. Characteristic peculiarity of this kind, however, would of necessity be chiefly limited to those cases—at present exceedingly rare ones—where the interior of the shop itself is fitted up, like some of the Parisian ones, with regard to effect as an architectural *ensemble*, so as to have more the air of an apartment furnished with certain articles there displayed, than of a mere warehouse where they are stowed away on shelves that entirely line the walls. The same diversity could not very well be extended to the exteriors, or shop-fronts themselves; because that would be apt to occasion a very disagreeable medley of all sorts of styles in our streets, and give them a most motley appearance. To be convinced of this, we need but look at Saunders and Woolley's shop-front in Regent Street. Whatever may be thought of the particular taste of embellishment—the so-called *Louis Quatorze*—there displayed, it is sufficiently significant; and we have no doubt that, as a design upon paper, shewn quite by itself, without any accompaniment, it made a striking and alluring appearance; yet, as actually beheld, it is as much of a blemish as a beauty,—no improvement to the street, except as affording a very showy display of window and costly articles of upholstery; and decidedly injurious to the façade where it has been introduced. The style itself is, moreover, by far too exotic and anomalous to be at all adapted for exterior architecture, even were an entire front to be designed in it so as to form a consistent composition. The Gothic style, however, that is, some varieties of it, might occasionlly be resorted to both with propriety and effect; although we are not aware of its having been hitherto applied to such purpose, except at Fairs's, in Mortimer Street, an exceedingly small, at least very narrow, upright strip of Elizabethan architecture, clever, and not a little picturesque. That the pale bronze hue given to that pretty architectural façade is attended with other advantage than that of rendering it more conspicuous, is what we will not undertake to decide; since greater variety, and quite as much propriety in regard to colouring, might have been obtained, imitating the weather-stained tints of stone and brick, with, perhaps, some of the mere ornamental parts in imitation of bronze, or other metal.

Our catalogue of *shops*, would be longer than Homer's catalogue of *ships*; and, we venture to say on our part, not very much more interesting, were we to note all that aim at being remarkable as well as fascinating. There is hardly a street of them at the west end of the town, in which one or more will not be found affording evidence of a desire to attract observation by something more than the show of goods behind the glass; but we cannot say that many of the designers have displayed much fancy or taste, or greatly taxed their invention for the benefit of their employers. In almost all of them we perceive some little, and but very little, aim at originality—a mere beginning towards it—in scarcely one instance a complete developement of a novel idea; consequently, there invariably seems to be more pretension than actual performance. Colnaghi and Puckle's new shop-front, in Cockspur Street, presents some novelty of style and detail, and is remarkable for the great projection of the cornice, which is brought forward as much as the half-octagon bay in the upper part of the house. The style itself partakes of both the *Renaissance* and the Elizabethan; and, independently of the panels with which they are embellished, the extreme piers assist the design very much, both by giving an air of stability to the *ensemble*, and a suitable termination to it. Cowie's, in Holles Street, is singular, chiefly on account of the window shewing itself somewhat like a glass-case inserted in the front, and being dark brown relieved with gilding; while the door, which is detached from it, has enormous white consoles, enriched with gilt mouldings, though all the rest are of very dark hues; a contrast of colours more *tranchant* and striking than tasteful. In the adjoining street, viz. Henrietta—Marshall and Stinton's makes a quiet sort of display with its four three-quarter Ionic columns, between which are three arches, of which the two forming the windows are each filled in with a single sheet of plate glass; which species of luxury is not rendered less singular by the extreme plainness of the windows themselves. We should recommend some liberal decoration in the spaces between them and the columns.

The new front of No. 76 in the Strand, now the "Foreign Marble Warehouse," may be cited as almost the very reverse of the preceding, being as studiously embellished as the other is studiedly kept plain. What little design there is in the shop itself, has neither much novelty nor much taste; it is the elevation above, and in a manner distinct from it, which presents a sample of an unusual mode of embellishment, it being liberally, yet not too liberally, decorated with medallions and figures in relief between the windows; and but for the disagreeable heaviness of the odd-looking cornices to the windows of the first floor, would be an agreeable composition, though susceptible of improvement in other respects besides the defect just pointed out. Had the exterior of the adjoining house been added to the design, so as to give greater width to the elevation, the effect would have been increased in more than arithmetical progression.

ON THE SUPPLY OF WATER TO THE METROPOLIS.

Observations on the past and present supply of Water to the Metropolis. By THOMAS WICKSTEED, *Civil Engineer. Read before the Society of Arts, May* 24, 1835.

(Continued from page 12.*)*

DURING the next two centuries, namely, from A.D. 1600 to A.D. 1800, were established several water-works of minor importance, as follow:

To the Merchant Water-works belonged three engines for raising water; one a windmill in Tottenham Court Road Fields; and two overshot water-wheels, worked by the water of a common sewer in St. Martin's and Hartshorn Lanes in the Strand; there were three mains of 6 and 7 inch bores to supply the respective neighbourhoods.

The Shadwell Water-works, erected about 1660, had first a horse-wheel, and afterwards two atmospheric engines, which supplied the neighbourhood with Thames water through two mains of 6 or 7 inch bores.

In 1691 these works, which had previously belonged to the family of Thomas Neale, Esq., were vested in a company of proprietors, who were incorporated by an act of Parliament 3rd and 4th of William and Mary. Two engines, of Boulton and Watt's manufacture, were afterwards erected; the first was one of the earliest engines made by them. When the London Docks were made, the district was much reduced in consequence, and the works were purchased by the Dock Company; and afterwards an act was obtained in 1808 by the East London Water-works Company to enable them to purchase these works, which they did. The works were in play for a short time afterwards, but were eventually given up, the supply from the Company's new works being superior.

The York Buildings Water-works, in Villiers Street, Strand, were established in 1691. The Thames water was raised for the supply of the neighbourhood, first by a horse-wheel; afterwards previous to the year 1710, they had one of Savery's engines; and a few years afterwards one of Newcomen's. Maitland says in his work, published 1756, that "the directors of this Company, by purchasing estates in England and Scotland, erecting new water-works and other pernicious projects, have almost ruined the company. However, their chargeable engine for raising water by fire being laid aside, they continue to work that of horses, which may in time restore the Company's affairs." This was true for a time, as it appears that from 1789 to 1804 this Company paid good dividends, but afterwards, in consequence of the ruinous competition that arose at that time, and for some years subsequently, a new engine was erected of 70 horses power, iron pipes laid down instead of wood, and no more dividends were paid, excepting 1*l*. per share for two years, out of the *capital;* and in 1818 the Company was ruined, the establishment broken up, and the district was supplied by the New River.

In 1775 Mr. Watt mentions an engine of Newcomen's at the York Buildings, and Mr. Farey calculated its power at about 26 horses, working 7 hours per diem, and raising during that time about 356,000 gallons to a height of 102 feet, or 3,137,000 barrels per annum. In 1810 the quantity raised at these works was only equal to 178,200 gallons per diem, or 1,544,400 barrels per annum. In 1818, before the breaking up of the establishment, the quantity raised was 762,588 gallons per diem, or 6,609,252 barrels per annum; which supplied about 2636 tenants.

The Chelsea Water-works were established in 1722 by an act of Parliament, in the 8th of George I., for the better supplying the city and liberties of Westminster, and parts adjacent, with water.

The Thames water was raised from settling-ponds, in the first instance, by a water-wheel, which was worked by the water collected in large ponds as the tide rose, and kept in until the water in the river lowered, when it was let out and worked the wheel: afterwards two of Newcomen's engines were erected, and in 1782 one of Boulton and Watt's engines,—one of the earliest erected in London.

The West Ham Water-works were set on foot in 1743, and a company was established by act of Parliament the 21st of George II., in 1747. The water was raised out of one of the branches of the River Lee by a fire-engine of about 6 horses power; these works were afterwards purchased by the East London Water-works Company, at the same time that they purchased the Shadwell works; and the power now used is a water-wheel of about 16 horses power.

Previous to the year 1756 there was a horse-machine for raising Thames water through a 7-inch pipe in Southwark, called the Bank End Water-works. A company was formed in 1758, under the name of the Old Borough Water-works Company, which, together with the London Bridge works, supplied Southwark. A steam-engine was erected afterwards; and in 1823, upon the removal of the London

Bridge water-wheels, the two works were consolidated, under the name of the Southwark Water-works, and became the property of John Edwards, Esq.

Previous to 1756 works were established at Rotherhithe. The water was raised by a water-wheel, which was worked by tide water, collected in the ditches and ponds in the neighbourhood, and kept in until the falling of the tide, when it was let out again into the river, and in its course turned the water-wheel; it supplied the neighbourhood plentifully through two 6-inch mains.

Previous to the year 1767 works were established at Lee Bridge, upon the river Lee, worked by a water-wheel, for the supply of Hackney and Clapton; they were called the Hackney Water-works, and in 1829, after which period they became the property of the East London Water-works Company, they raised about 600,000 barrels per annum for the supply of about 600 families.

In 1785 the Lambeth Water-works were established by act of Parliament 25th of George III., to supply the district upon the south side of the Thames, exclusive of the parishes of St. George's and St. Saviour's Southwark. The water was raised from the Thames near Waterloo Bridge by steam-engines.

From the year 1800 to the present date, the following works have been established:

In 1805 the South London Water-works were established by act of Parliament 45th of George III., to supply the district on the south side of the Thames not already supplied by the Lambeth and Southwark Water-works. The works are at Vauxhall.

In 1806 the West Middlesex Water-works were established by act of Parliament 46th of George III. The works are at Hammersmith, and they supply Hammersmith, Kensington, Paddington, and Marylebone.

In 1807 the East London Water-works were established by act of Parliament 47th of George III.; they have works at Old Ford, which is their chief station for the supply of the eastern parts of the metropolis. They have purchased the Shadwell, West Ham, and Hackney Water-works, and have works and machinery for raising water at Stratford and Lee Bridge. Objections having been made in 1828 to the source from whence they raised their water, it being asserted that as the tide affected the river Lee in that part, the water "partook of the nature of Thames water," the Company, to remove all doubts, obtained parliamentary powers in 1829 to change the source of supply, and, according to the powers granted, they have, at an expense of nearly 80,000*l*., constructed reservoirs and a canal for the purpose of bringing water from a part of the river Lee which is far above the influence of the tide; so that now the water raised at Old Ford is *Lee Water only*. I mention this more particularly because it has been erroneously asserted that *Thames water* is supplied by this Company.

In 1810 the Grand Junction Water-works Company was established by act of Parliament the 51st of George III. This Company first supplied water from the Grand Junction Canal; this supply was not only limited, but was also objected to by some of the tenantry, who preferred Thames water: the works were accordingly removed to the banks of the Thames at Chelsea. This Company together with the West Middlesex and Chelsea Water-works Companies supply the western parts of the metropolis.

It appears that, in the *first* instance, when it was necessary to bring water from a distance, the Corporation were the chief promoters of all schemes for better supplying London; and never more so, than when they granted a lease of the London Bridge arches to Peter Maurice at a nominal rent; but it is probable that this supply never exceeded six millions of imperial barrels per annum—not 2 per cent. of the present supply.

Afterwards Sir Hugh Myddleton executed the plan for bringing the greatest supply to London; he was, however, ruined, the undertaking being too extensive for an individual.

And at last several wealthy men joined together, and subscribed money sufficient to execute large plans for efficiently supplying every portion of the metropolis, which is now most abundantly supplied with good water at the rate of ¾ths of a farthing for an imperial barrel, or 36 gallons, which is the amount received by the Water Companies for every barrel they distribute, according to the parliamentary returns. This abundant supply is continued through the night, to be used in case of fires happening.

In some of the suburbs of London water is still supplied by carriers. Where it is carried in buckets from wells, it is sold at the rate of 8*d*. per barrel, or 42 times as much as when supplied by machinery; and when it is carted from the river, at 4*d*. per barrel, or 21 times more than machinery. As it is more than probable that it could not be sold at a cheaper rate in ancient times, the advantages obtained by the introduction of machinery will appear very great.

In addition to the works before mentioned, there are the Kent and the Hampstead Water-works. The Kent Water-works are situated upon the River Ravensbourne at Deptford. The machinery consists of a water-wheel and two steam-engines. The water from this river is supplied chiefly to Deptford, Greenwich, Woolwich and Rotherhithe: these works are scarcely considered metropolitan.

The Hampstead Works are small; they are the same that have been mentioned before, and are the most ancient of any of the existing works. In 1803 the New River Company supplied the tenantry.

Present Supply of Water to the Metropolis.

According to the report of the Select Committee of the House of Commons in 1834, the quantity of water raised by the eight metropolitan water-works in the year 1833 was equal to 357,288,807 imperial barrels; the number of houses supplied was 191,066, and the average daily supply was above 35 millions of gallons, or 183 gallons per house upon the average.

The following detailed account is taken from the Parliamentary Reports:

The New River Water-works supplied in 1833, 171,975,000 imperial barrels of water, 21 millions of which were raised by machinery 60 feet above the level of the New River Head, the remainder supplied by the river, which is 84 feet above the level of the Thames, a sufficient elevation to supply ⅞ths of the New River district without the aid of steam or other power. The number of houses supplied was 70,145; the capital expended from the commencement of the works has been 1,116,964*l*.; the rental received from the houses supplied with water amounted to 98,307*l*., and from lands and houses 6601*l*., or a total income of 104,909*l*.; the expenditure was 61,163*l*., leaving 43,746*l*. to be divided, or not quite 4 per cent. upon the capital. These works supply the greatest number of houses.

The East London Water-works rank next to the New River Water-works; the quantity of water supplied by them in 1833 was equal to 56,715,890 imperial barrels, all raised by machinery, under an average pressure of about 110 feet: the number of houses supplied was 46,421; the capital expended from the commencement of the works has been 594,988*l*.; the gross rental was 53,061*l*.; 22,166*l*. was divided, not 3¾ per cent. upon the capital.

The Lambeth Water-works supplied 17,997,903 imperial barrels in 1833, all raised by machinery; the number of houses supplied was 16,682; the capital expended from the commencement of the works has been 182,553*l*.; the gross rental was 14,808*l*.; and 3,840*l*. was divided, not 2⅛ per cent. upon the capital.

The West Middlesex Water-works supplied in 1833, 30,000,000 imperial barrels, all raised by machinery; the number of houses supplied was 16,000; the capital expended from the commencement of the works has been 404,263*l*.; the gross rental was 45,500*l*.; their shares are valued at 68*l*. 8*s*. 9*d*., and 3*l*. per share was divided, less than 4½ per cent. upon the shares, but more than 6 per cent. upon the capital expended.

The Chelsea Water-works supplied in 1833, 23,629,500 imperial barrels, all raised by machinery; the number of houses supplied was 13,892; the capital expended from the commencement of the works has been 271,311*l*.; the gross rental was 22,906*l*.; 4,800*l*. was divided, or 1¾ per cent. upon the capital.

The South London Water-works supplied about 12,166,666 imperial barrels in 1833; the number of houses supplied was 12,046; the capital expended from the commencement of the works has been 245,306*l*.; the average per share was about 245*l*., and they were last sold at 85*l*. per share; the gross rental was 8,839*l*.

The Grand Junction Water-works supplied 32,553,850 imperial barrels in 1833; the number of houses supplied was 8,780; the capital expended from the commencement of the works has been 331,174*l*.; the gross rental was 26,154*l*.; dividend rather more than 4 per cent.

The Southwark Water-works supplied 12,250,000 barrels in 1833; the number of houses supplied was 7,100; the capital expended since 1823, when the Old Borough and London Bridge works were consolidated, has been 25,000*l*.; the works belong to private individuals, who state that the Borough Water-works did not pay 1 per cent, and the London Bridge never more than 3 per cent.

The whole capital expended since the establishment of these water-works has been 3,171,559*l*.; and the amount of dividend upon this capital in 1833 was between 3 and 4 per cent. All of these were for many years without any dividend, and frequently much lower than that before named,—seldom higher.

I think the foregoing statement will prove that the profits of the public Water Companies have not generally been very exorbitant; and that, whatever objections may be made in particular cases, great credit is due to the enterprise of those who have, for a trifling gain, risked their property for the public good.

I cannot proceed further without remarking, that in the observations

I have made, and am about to make, I am not advocating any particular interests, but merely expressing my individual opinion of a great public good; nor do I think the circumstance of my being at present connected professionally with one of the largest of the Water-works Companies should be any bar to the expression of an independent opinion. In the following observations, I can only regret that others more competent have not taken the task in hand, knowing, as I do, how many there are connected with this Society infinitely better able, from age and experience, to do justice to the subject.

That Great Britain stands pre-eminent amongst nations is not only on account of the valuable minerals in which she abounds, and which is accidental, but also on account of the industry and perseverance of her subjects enabling them to overcome the greatest difficulties, and to avail themselves to the fullest extent of the resources Nature has blessed the islands with.

The chief reason that there are larger and nobler establishments for the public good is, that in England, instead of the Government executing and controlling the large public works, enterprising individuals join together, and, each subscribing a portion of his property, execute the largest and grandest works. The only inducement is the fair expectation that the money subscribed will yield an equitable return for the risk incurred. This return is made by that portion of the community who derive advantages from the undertaking,—advantages which could not be obtained excepting by joint subscription. If any work is undertaken which, although beneficial to some portions of the community, is not to others, that only which derives the benefit pays for it; whereas, if it were undertaken by Government, in many instances the *whole* would have to pay for the *part* enjoying the benefit, or no works upon a similar plan to those which, until of late years, were peculiar to Great Britain, would be undertaken, as the acquiescence of the majority must be obtained before a wise Government would embark in any large undertaking.

This system, as every other, may be abused; but I am speaking of the system when it is properly worked, not otherwise.

The case of Sir Hugh Myddleton is one showing directly the necessity of many individuals joining together; the undertaking was too large, and the risk too great for one man, to ensure a safe return; he therefore was ruined. If in the first instance others had joined with him, a portion only of his fortune would have been lost. It is not to be expected that Companies can be formed without a fair chance of a return for the money risked: and as the benefit derived from great public works cannot be obtained otherwise, the nation, while it is doing right to guard against abuse, must, on the other hand, be cautious that, by requiring too much, it does not render the article too costly, and thus put a stop to the system. Every Company, as every individual, expects and ought to be remunerated, otherwise there is an end to companies.

There have been many abuses of the system, and a consequent suspicion of it; individuals not unfrequently most honestly undertake to expose these abuses,—it is a difficult task; care must be taken that in attempting to cure a limb the whole body is not, through ignorance, destroyed.

In determining upon the supply of water to a large district, the chief points to be attended to are, first, whether it is to be obtained at such a cost that those who risk their money to obtain it can supply it at an unobjectionable price, and at the same time be fairly remunerated; second, that the quality be good; and third, that the quantity be abundant.

On the first I have to observe, that in London, with the exception of the greatest portion of the New River supply, the water has to be raised by the power of steam to dwelling-houses situated *above* the source; and by the same power it must be forced through pipes, so that each inhabitant shall have a supply: to preserve and continue this power is the greatest source of expenditure in water-works. *If* water cannot be obtained in the *neighbourhood* at a sufficient elevation to run into the houses of the inhabitants, recourse must be had to mechanical power, or the plan of carrying water from a distance by human labour must be readopted. The power necessary is in proportion to the quantity of water required and the height to which it has to be raised. If the elevation is 100 feet, it will require double the power that it would if it were only 50 feet; if, therefore, the rivers near London are discarded, and deep springs are resorted to, the height to which the water will have to be raised will be at least 100 feet greater than the height from the rivers, and the expense will be proportionately increased, which must be met by increased payment for the water. To raise the present supply of London 100 feet high, without considering friction, a power equal to about 1480 horses will be required, working 12 hours per diem.

In addition to this, as the water supplied by the New River Company is now delivered by their river at 84 feet above the water of the Thames, taking the average pressure at 60 feet, an additional power of 430 horses, working 12 hours per diem, would be required, or a total increase of power equal to more than 1900 horses. To establish and maintain this power would require an investment of capital equal to about 1,500,000*l*. The same reasoning will apply to *filtering* the *whole* supply.

This fact must be borne in mind, that if more capital is laid out in what is, often erroneously, termed *improving* the supply, higher rates must be paid; and if those who pay for the water are not satisfied, and are willing to pay higher rates, they can have a more costly article; and that if any alteration is made in the general supply of water, which leads to increased expenditure, whether this is made by the Companies already established, or by new Companies, the case is the same,—higher rates must *eventually* be paid, whatever is done in the *first* instance; and this appears to me a statement which no unprejudiced individual can gainsay;—I am speaking of the *general* supply, not of any particular cases.

And this brings me to the second point, namely, quality. From the parliamentary inquiries lately made, it appears that owing to the improved drainage in London consequent upon the abundant supply of water which has of late years flowed into the sewers, the water of the river Thames had in that portion in which the drainage took place become inferior in quality to what it had been before. The strongest evidence upon this subject was that of Dr. Bostock, a gentleman of well known experience in the analysation of waters; he stated distinctly that the impurities of the water were mechanical, and might be separated by filtration. It would also be well to notice what proportion of the supply of London comes from this objectionable source: about 65 per cent. of the whole supply is *not* Thames water; about 22 per cent. is either taken above Hammersmith Bridge, beyond the influence of the London drainage, or is filtered; and as to the remaining 13 per cent., powers are, or are about to be obtained forthwith to change the source of supply. In the latter case delay has been occasioned by a belief, justly founded, that Parliament would have proposed a plan for their supply; and in fact, powers were refused the parties until it was determined whether this would be the case or not.

For drinking, spring water is the pleasantest; and although it may contain certain salts, which render it hard and unfit for domestic purposes, it is not in the slightest degree injurious to health. Few would prefer river water to drink, if they could obtain spring water, as the very quality of softness which renders river water so valuable for general purposes, is that which renders it flat and unpalatable, namely, the absence of salts, which causes the water to be hard.

Thirdly, as to quantity; that this is a point of very great importance may easily be proved. In 1833, 191,066 houses were supplied with water; the quantity of water raised was 35 millions of gallons daily. Supposing each house required 9 gallons per diem for drinking in the simple form, or otherwise, this would amount to $\frac{1}{20}$th of the whole quantity, or 5 per cent.; and the remaining $\frac{19}{20}$ths, or 95 per cent., is required for washing, cleaning sewers, watering gardens, and running down the channels in the public streets, and a portion for manufacturing purposes, and for fires.

The Water Companies are bound to give an abundant supply in case of fire; and during the time that the cholera morbus raged, a gratuitous supply was given, and the water was allowed to run out of the mains down the streets, alleys, and courts whenever required;—in the first instance insuring the lives and property of the public against fire; and in the second, preventing the spread of disease by rendering the whole, but especially the thickly populated parts, of the Metropolis healthy.

If, therefore, so small a quantity is required for drinking, and so large a quantity for other purposes, it would be a very imperfect scheme which sacrificed the latter for the former.

If a purer water *can* be obtained, and *is required*, either from deep springs or by universal filtration, as this cannot be done excepting by an enormous outlay of capital, and a proportionate increase of rates, which is preferable,—that the whole 35 millions used for all purposes should be filtered; or that for a short season every year, when the rivers are discoloured, each inhabitant should have a portable filter, which may be obtained for 20*s*., and filter the twentieth part? That the latter would be the cheapest to the consumer I am quite satisfied. I am of course speaking now of that portion of the supply out of the influence of the London drainage, and which is only mechanically affected in rainy seasons, at all other times being clear and free from mechanical impurity. I say mechanical impurity, in contradistinction to chemical impurity: the first may be got rid of by deposition or filtration; the second cannot be got rid of but by changing the source. The evidence, however, given before Parliament shows that none of the water supplied to London is so *chemically* impure, as to be in the least degree injurious to health.

That all inquiries into abuses are good and desirable there is no denying, but it appears to me that exaggerated statements have been made of the abuses in Water Companies, and that it is not generally borne in mind that if any increased outlay is necessary it may be effected at much less cost, eventually, to the tenantry, by those whose works are established and whose experience is great, than by others; and the fact that great works have lately been executed by some Companies, and that more are about to be undertaken by others, without increasing the rates, shows a disposition on the part of those engaged in them to make the good of the public their first object. That some are obliged to increase their rates, upon a greatly increased expenditure, arises from the difficulties being so great that the Company could not be carried on without it, and unless other parties will undertake, and *be bound under sufficient securities*, (to be determined by Parliament,) to supply such districts at lower rates, an increase should not be objected to.

I am fearful I have too long occupied the time of the Society in observations which, as they are those of an individual only, cannot be of much importance; but thanking them for their kind intention, I will conclude by an explanation of the mode in which a town is supplied with water according to the present system.

If any town be so fortunately situated that a supply of water may be had from springs in the *neighbourhood*, of good quality, abundant in quantity, and at a sufficient elevation to overcome the friction created by the passage of the water through the pipes, and to allow it to run into the upper stories of the dwelling-houses, the arrangement for the supply will be simple, and the annual expense beyond the interest of the capital expended will be trifling. It is, however, but seldom that such is the case.

In general the water has either to be raised from the rivers in the immediate neighbourhood at a great and continual expense of power; or, where there are no fresh-water rivers within a practicable distance, from deep wells; in which case the necessary power will be doubled; or, lastly, should there be a river in the neighbourhood, and it should be desirable to avoid the continual expense of steam power, it may be effected by bringing a cut from such part of the river that the elevation obtained by going a considerable distance up the stream produces a sufficient head without the aid of machinery, as in the case of the New River. The head is obtained thus: the natural fall of the river from whence the water is taken is so much greater than is necessary to produce the required velocity for the water through the canal, that the difference in levels makes the required head.

If an opportunity is afforded of adopting either the mode of bringing it from a distance by means of a canal, or by pumping from the river by steam power, the choice will be determined by the result of the estimate of the cost. The canal will cost more than the steam power in the first instance; and to determine which is the least expensive, the interest of the capital expended added to the annual expense of keeping the canal in repair must be compared with the interest of capital expended for the steam power added to the annual amount for repairs, *and the cost of fuel and wear and tear of the steam power.*

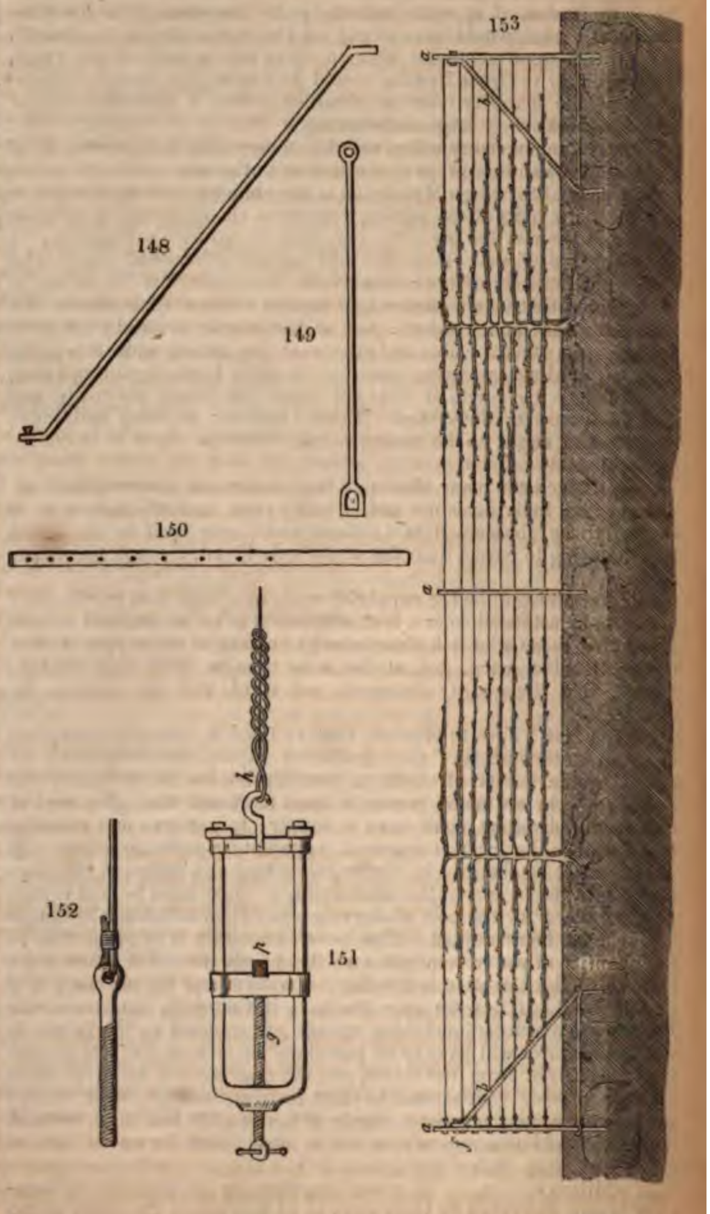
In small towns one line of pipes communicating with the source passes through the streets, and each inhabitant is supplied at the same time. In larger towns, where the number of houses to be supplied is great, and the distance that the water has to travel is also great, recourse is had to the following contrivance: in the principal streets mains are laid, which convey the water from the source; and branching from these mains, other smaller-sized pipes are laid, called services; at every point where the services branch from the mains a cock is attached, by means of which the communication with the main is either opened or shut off; from the services small lead pipes branch to each dwelling-house, and whenever the communication is opened with the mains, which *are always charged*, the houses whose lead pipes are joined on to the service receive a supply of water.

The necessity for such an arrangement will be made obvious by the following statement:

When water is forced through pipes either by a natural or artificial head, or by steam or other power, friction is created in proportion to the velocity of the water and length of the line of pipes. As the distance increases, the power must either be increased or the velocity reduced; the shorter the distance, the less the power required to overcome the friction; if, therefore, it is necessary to exert a great power to force the water to the extremities of an extensive district, that they may be properly supplied, it is very evident that the power which is exerted near to the source, not being required to overcome so great an amount of friction as at the extremities, must be applied to increase the velocity of the water through the orifices near the source; and if, therefore, such an arrangement as the one herein before mentioned were not adopted, the effect would be that those houses which were near the source would have a superabundant supply, while those at a distance would have a very small supply, if any; but, by means of the system mentioned, when the inhabitants near the source have received their supply the cocks on the services are shut down, and the water in the mains passes on to supply the services at the extremities, which will have a sufficient supply, because the water, not being used before, must pass on to the extremities. That each may have an *equal* supply, those that are near the source have the communication opened with the main for a shorter time than those at a distance, in proportion to the velocity with which the water is delivered.

In addition to this, on every line of mains and services orifices of about 2 inches diameter are made at certain distances, which are filled up with what are termed "fire plugs," being nothing more than wooden spigots made to fit the orifices; these are easily fitted and as easily removed, and in case of a fire they are started, and a supply is given directly. The strength of this supply is regulated by means of the system before mentioned; thus, by closing the service cocks in the other parts of the district, the whole force of the water may be concentrated in that part where the fire has occurred.

WIRE FENCES.



WIRE FENCES.

(From the Gardener's Magazine.)

At an ordinary meeting of the Horticultural Society of London, the following letter to the secretary from Mr. W. B. Booth, was read, upon the mode of constructing wire fences for training espalier fruit trees upon, and for other purposes.

"*Carclew, January* 29, 1839.

"Sir, I beg to hand you the following particulars respecting some wire trellises lately erected here, which you may, probably, not deem unworthy of submitting to the notice of the Horticultural Society.

"The object for which they are intended is the training of espalier fruit trees; and it occurred to me, in the course of erecting some wire fencing to divide a portion of the park, that a similar kind of erection might be advantageously introduced into the kitchen-garden, which would answer the same purpose as the expensive wooden or cast-iron trellises usually met with in those places where the espalier mode of training is adopted. I accordingly submitted the plan to Sir Charles Lemon, who has since had it carried into execution to a considerable extent.

"Wire erections of the kind I am about to describe are not uncommon, I believe, as fences, in some parts of the kingdom; but in Cornwall it is only within the last few years they have been introduced. Mr. Gilpin, in his excellent *Hints on Landscape-Gardening*, p. 217, has noticed the wire fence as being best suited for those parts near to the house, or to the approach, but he has not shown the manner in which it may be erected. The accompanying sketches and details will, I trust, supply this deficiency, and enable any one who may be desirous of erecting a wire fence or trellis to do so, with the assistance of a mason and blacksmith, at a very moderate expense. The wire used is known as No. 32. It is about a quarter of an inch in diameter, and is put up in large coils. Each wire measures from 115 ft. to 120 ft. in length. The main upright posts fig. 153 *a a* are of iron, 1¼ in. square, and from 5½ ft. to 6 ft. high, with holes 6 or 7 inches apart for receiving the small screws and nuts, to which the wires are attached in the way shown at fig. 152. At the opposite end the wire is secured by being bent a little at the point, and having a small wedge driven over it in each of the holes of the upright. Both these main posts are 4½ ft. above the level of the ground, and are fixed beneath the surface in large rough blocks of stone *d e*, with iron wedges, which are more convenient, and answer the purpose quite as well as if they were run in with lead. The stay-bar is round, and 1¼ in. in diameter, It varies in length according to the inclination of the ground, but when the latter is nearly level it is about 7 ft. long. The upper end is flattened, and beveled, so as to square with the upright, to which it is fixed by means of a screw at *f*. The lower end is only a little bent, that it may fit into a somewhat smaller block of stone *e* than the one at *d*. The connecting bar *c* is square or round, and need not exceed an inch in either case. It will also vary in length, according to circumstances. On a nearly level surface it must be about 5 ft. long, and have an eye at each end large enough for the end of the post and stay to go through. In addition to this, there are uprights of one-inch flat bar by half an inch in thickness fixed in stone, at 30 or 40 ft. apart, or even nearer if necessary, for the purpose of stiffening the trellis.

"In the erection of this kind of trellis, it is requisite to have an instrument for drawing the wires like the one represented at fig. 151 to the scale of an inch to a foot, which may be made without much difficulty. The one I have sketched was constructed by our own blacksmith, and is a very efficient contrivance for the purpose. After the stones are bored and set in their places, with the earth firmly rammed around them, the next thing to be done is to fix the main post *a*, and wedge it tight. It ought to lean about an inch back from the perpendicular, to allow for its giving a little when the whole strain of the wires comes upon it, which will bring it upright. The connecting bar *c* is then slipped down over it, while the lower end of the stay-bar *b* is put through the other eye and into the stone *e*, and the upper end screwed to the main post at *f*. The triangle from which the wires are to be stretched is then complete. A similar triangle must be made at the opposite end, and against the main post of which *p* the instrument above noticed is to be placed for the purpose of drawing the wire. This is done with great facility by means of a double piece of rope-yarn twisted several times round the end of each, and hooked, as shown at *h*. The screw *g* is then worked until the wire enters its proper hole in the post *p*, when it is bent and secured by a wedge, as already stated. The nuts on the bolts fig. 152, at the end from which the wires were drawn, are then screwed up a little, so as to make all the wires as tight as possible. The cost of the whole averages from 1*s.* 6*d.* to 2*s.* per yard.

"I have been thus minute with the details of the trellis and the mode of erecting it, in order that those who approve of it may be able to have others erected on the same plan, for either of the purposes to which it has been successfully applied at Carclew.

"I am, Sir, your very obedient servant,

"Wm. B. Booth."

STEAM BOAT PROPELLERS.

Sir—Whatever effect the experiments of Geo. Rennie, Esq., on steam-boat propellers, may have on the public generally, allow me to say, that I consider conclusions more erroneous were never before formed from any experiments, and with your permission I will attempt to prove, that the assertions relative to the superiority of the spear-shaped paddles are utterly without foundation. And what are these assertions, and what are we called on to believe? Why, that the floats of a paddle-wheel, when made in the shape of a trapezium, (with the acute ends down,) present double the resistance to the common rectangular floats with three times the width and equal area! A most important discovery certainly; and pray how is it that all our writers and experimenters on practical hydraulics have neglected to make known to us this peculiar but important property of the trapezium? Is it not for this simple reason, and this only, that they never could have discovered that such a property belonged to it? Indeed, it is a most glaring inconsistency to imagine that a flat surface, fashioned into a trapezium, can present double the resistance to a rectangular surface of equal area: we say that there is no authority whatever for the assertion, and happily for us Mr. Rennie has placed the proof within our reach.

We find, in the second table of experiments, (p. 25 of the Journal,) that a paddle-wheel of 3 ft. 3 in. diameter, with rectangular floats $9\frac{1}{2} \times 4$ in., the total area of floats immersed being 228·8 sq. in., propelled the boat at the rate of 2·8 miles per hour, with 41·8 revolutions of the winch per minute. Also, that with trapezium-shaped floats, $9\frac{1}{2} \times 4$ in. (the acute ends down,) and immersed area 107 sq. in., with a wheel 3 ft. 10¾ diameter, and 47·5 revolutions per minute, the same boat was propelled at the rate of 2·9 miles per hour.

In the first case, *i. e.* with rectangular floats, we shall find on calculation, that the centre of pressure, (assuming it in each case to be the centre of the floats,) travels at the rate of 382·9 ft. per minute, or 4·35 miles per hour, and the velocity of the boat is stated to be 2·8 miles per hour; the difference between these two quantities $(4{\cdot}35 - 2{\cdot}8) =$ 1·55 miles per hour: this is the rate at which the floats, with an area of 228·8 sq. in. recede in the water, to obtain resistance sufficient to propel the boat at the rate of 2·8 miles per hour.

In the other case, *i. e.* with trapezium-shaped floats, we shall find, in the same way, that the centre of pressure travels at the rate of 466·3 ft. per minute, or 5·3 miles per hour, and the velocity of the boat being only 2·9 miles per hour, shows that the floats, having an area of 107 sq. in., recede at the rate of 2·4 miles per hour, to produce an equal resistance, (or nearly so) to the rectangular floats.

A writer in that excellent and useful publication, the Mechanic's Magazine, states the propeller to be "an important modification of the old paddle, being an ingenious application of a most simple and beautiful principle in nature," and mentions also the observation of the talented inventor, Mr. Rennie, "that nature never attains her ends but by the best and most efficacious means," meaning, of course, that the propeller in question is "the best and most efficacious." As Mr. Rennie seems to have followed *nature* so closely in his invention, it seems passing strange that he should have overlooked another of her principles, equally simple and important, viz. that of *the resistance opposed to the motion of a body through water being as the square of the velocity:* had he tested the performance of his floats by this simple law, he would have seen at once on which side the efficiency rested.

With the rectangular floats, we have seen that the recession, or the velocity of the floats through the water, is 1·55 miles per hour; the square of this is $1{\cdot}55 \times 1{\cdot}55 = 2\,4025$.

The recession of the trapezium-shaped floats is also shown to be 2·4 miles per hour, the square of which is $2{\cdot}4 \times 2{\cdot}4 = 5{\cdot}76$.

The *area* of the immersed floats necessary to produce an equal resistance in each case, is of course inversely as their velocity; and taking the area of the rectangular floats moving through the water at the rate of 1·55 miles per hour, at 229 sq. in., we find, by simple proportion, the area of the *same sort of float,* necessary to produce an equal resistance when moving through the water at the rate of 2·4 miles per hour, to be only 95·5 sq. in. for 5·76 : 2·4025 : : 229 : 95·5. Hence we see plainly, that had the *rectangular* floats been of equal area *only* with the trapezium-shaped floats, and *travelled at the same velocity,* the resistance would have been quite as great, if not greater; for the area of the immersed trapezium floats is stated to be 107, and the calculation shows that 95·5 sq. in. would have been sufficient with rectangular floats.

But we have no occasion to stop here; Mr. Rennie has tried the merits of the two kinds of floats on a larger scale, (viz. with the "Pink" steamer,) and we shall be able to show, that instead of being superior, the trapezium-shaped floats prove themselves to be infinitely inferior to the rectangular, as the experiments are made on a larger and fairer scale.

Pursuing the same method of calculation, we find that in the wheel with rectangular floats, the centre of pressure travelled at the rate of 754·8 ft. per minute, or 8·56 miles per hour, whilst the boat only travelled at the rate of 6·7 miles; then 8·56—6·7 = 1·86, for the recession of the rectangular floats with 635·6 sq. in. surface. The centre of pressure of the trapezium-shaped floats travelled at the rate of 829 ft. per minute, or 9·41 miles per hour, and the boat 6·34; then 9·41—6·31 = 3·07 for the recession of the trapezium floats per hour, having a surface of 432·25 sq. in. The square of 1·86 = 3·4596, and the square of 3·07 = 9·5249, then 9·5249 : 3·4596 : : 636 : 231 sq. in. Here we again see, that had the *rectangular* floats had an area of only 231 sq. in., and *travelled at the same velocity as the trapezium,* the resistance would have been equal! Whereas it appears by the experiment, that the area of the immersed trapezium-floats, was 432 sq. in., or (432—231 =) 201 sq. in. *greater* than would have been necessary with *rectangular* floats.

Thus far, then, we think we have proved all that we attempted, and now let us ask, what are the other advantages besides a reduced area, which are said to be derived for the use of the trapezium-shaped floats? A reduction of two-thirds in the width of the paddle-wheels and boxes. Having clearly shown that no advantage whatever is gained as far as the *area* of the immersed floats is concerned, but rather loss of power incurred; what authority is there for asserting that placing the floats endwise is advantageous? On the contrary, do not the experiments prove this modification to be as good as disadvantageous? for we see that when the obtuse angle was down, a surface of only 103 sq. in. was sufficient to propel the boat at the rate of 2·8 miles per hour, with only 46·5 turns of the winch, and a 3 ft. 6½ in. wheel; but when the acute angle was down, the velocity was only 2·9 miles, with 47·5 turns of the winch per minute, and a 3 ft. 10¾ in. wheel. In fact, there is just as much authority for stating, and I make bold to say, that the results would be found equally as favourable, were the common rectangular floats also placed endwise, as the trapezium floats are when in that position.

The disadvantages of the common paddle-wheel are universally acknowledged, and it would therefore have been much fairer, had Mr. Rennie compared the effects of the trapezium floats with the cycloidal or the vertically-acting paddle.

Above all, it may not perhaps be rude to ask, who are the competent judges and witnesses who are said to "have seen the experiments repeated again and again and *tested* them?" I think I may venture to say that Professor Barlow was *not* one of them, though he is said to approve of the plan *theoretically.*

In sending you my views on the subject, I trust I shall not be accused of any motive unworthy of the subject, or of endeavouring to cast a slur over the efforts of the talented inventor; but Mr. Rennie should recollect, that assertions coming from so high a quarter, are much more likely to mislead than when made by an obscure individual. If I am wrong in my views and calculations, it will be easy to discover the seat of error and thus elicit truth, and I shall then be the first to acknowledge it; but should this letter be the means of preventing a needless expenditure of money, I trust that those interested will consider that, instead of inflicting an injury, I have conferred on them a benefit.

I am, Sir,
Your obedient servant,
J. L.

Yewsley,
Jan. 9th, 1840.

TRAVERSING SCREW-JACK.

Fig. 1.—Side view.

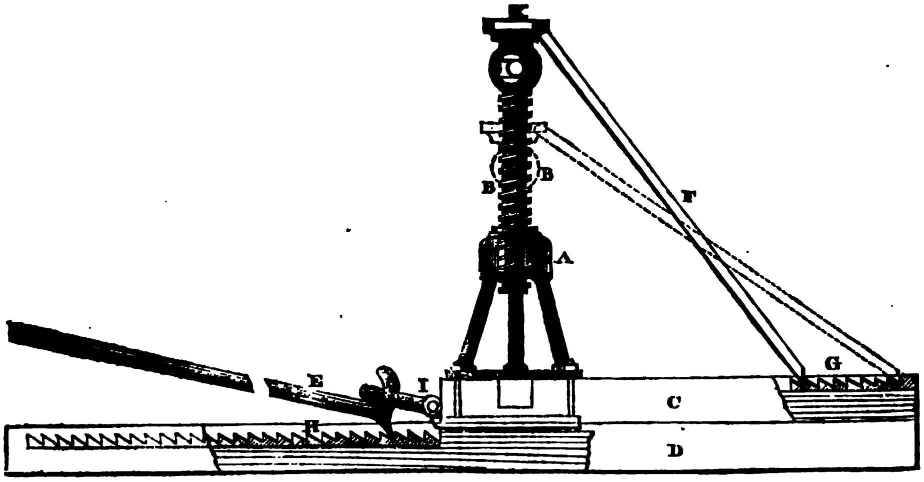
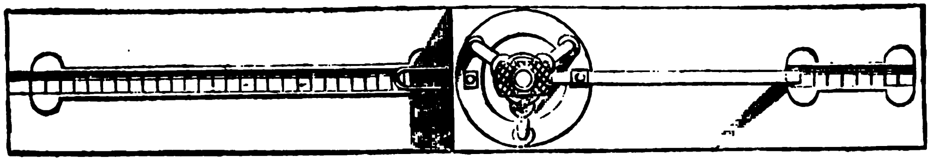


Fig. 2.—Plan.



TRAVERSING SCREW-JACK.

Figures 1 and 2 exhibit the screw modification. The screw-jack *a* is bolted to the plank *c*; at the other end of the plank is fixed the rack *g*, in which the toe of the strut *f* advances as the screw *b* is elevated; the strut works in a joint in the follower *k*: the position of the strut when the screw is depressed is shown by the dotted lines. The object of this strut is to relieve the screw of the violent cross strain to which the apparatus is subject, when the engine or carriage is pulled over by the lever; which strain is entirely transferred to the strut, and the screw has merely to carry the load.

*The oper*ation of traversing the jack is as follows: by hooking the link *i* upon the hook of the lever *e*, the toe of the lever being inserted into a ratch of the rack *h* of the lower plank, when a man, bearing down the end of the lever, drags the apparatus and engine or carriage towards him with great facility; the same lever is used to turn the screw, and to produce the traverse motion. By this apparatus an engine of 16 tons weight has been replaced upon the rails in five minutes by the engineer and stoker alone; thus those delays which are the subject of so much annoyance and loss to railway proprietors and the public, need not happen in future; the apparatus is exceedingly portable and cheap, and no train ought to be allowed to go out without its being sent along with it; it may be carried either upon the tender, or upon some other place which may be selected for it.

Plate 4.

M. DE L'OSIER'S
APPARATUS FOR RAISING WATER.

Fig. 3.

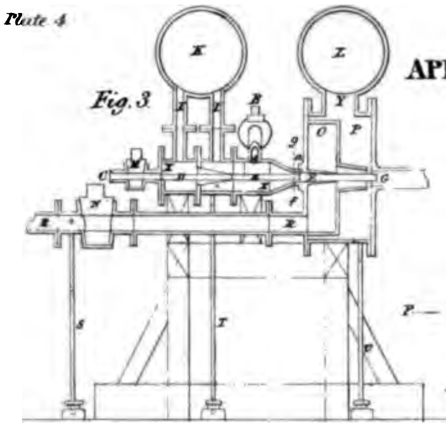
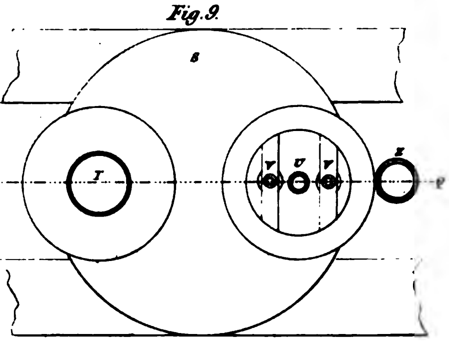


Fig. 9.



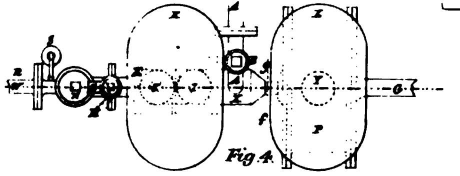


Fig. 4.

Fig. 5.

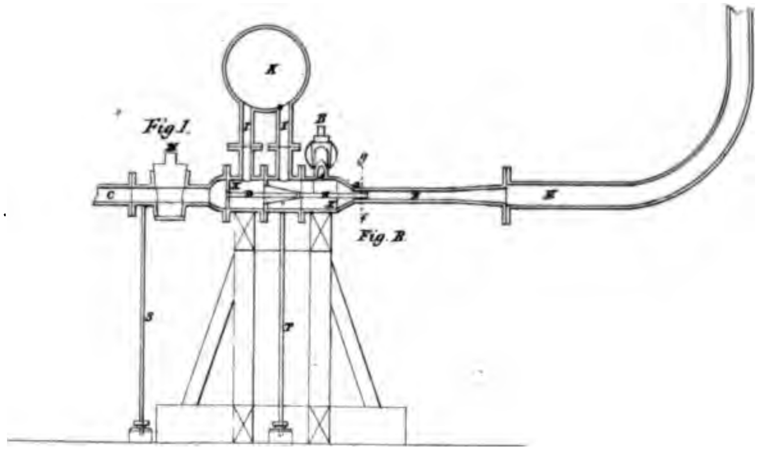


Fig. 1.

Fig. B.

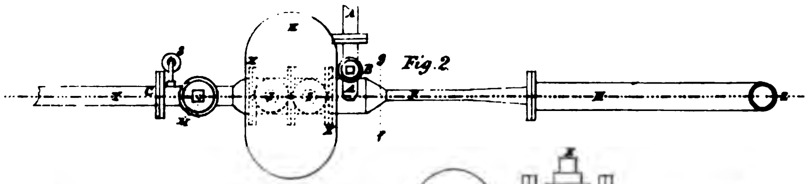


Fig. 2

Fig. 7.

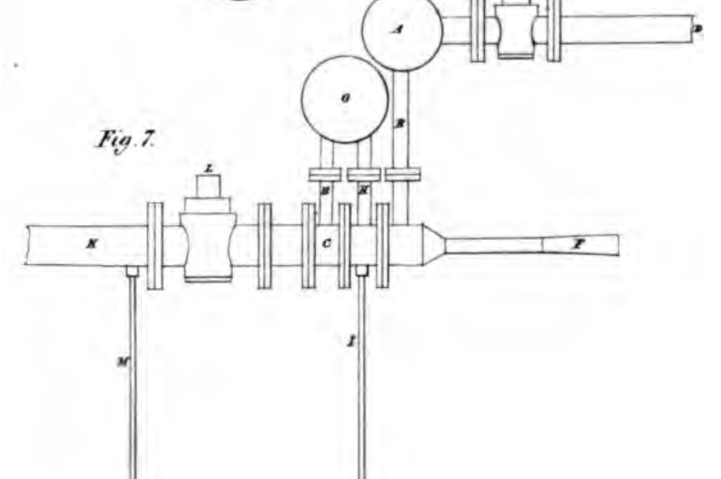


Fig. 8

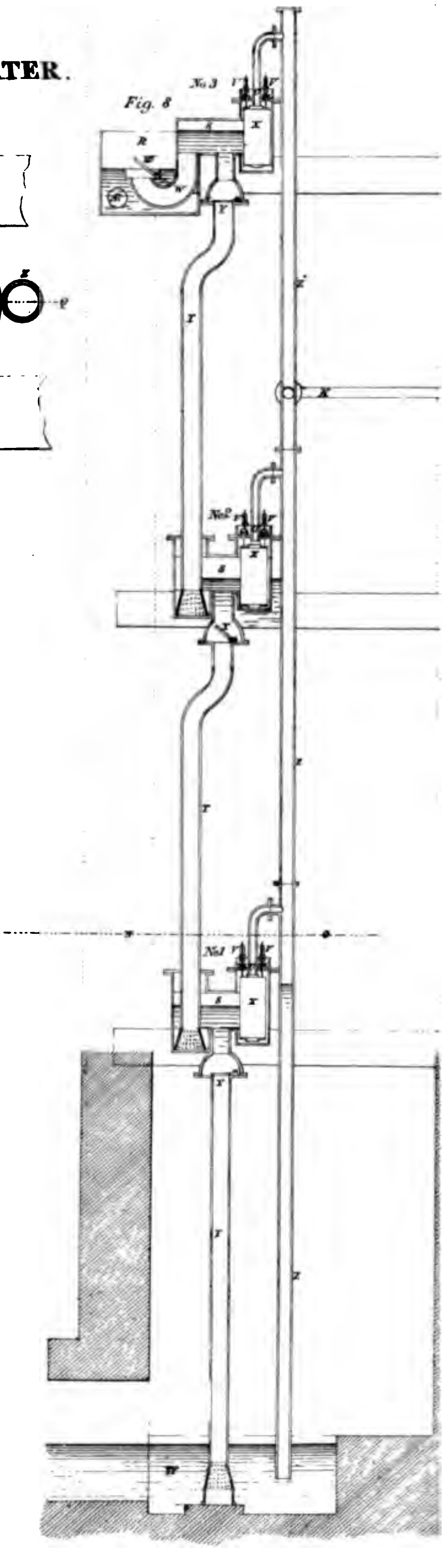
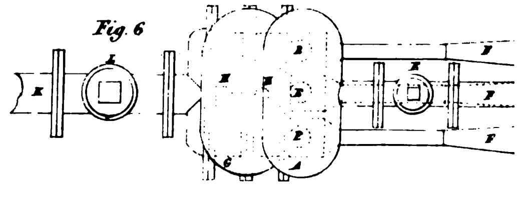


Fig. 6



J. R. Jobbins. Warwick Court.

APPARATUS FOR RAISING WATER.

PATENTED BY M. DE L'OSIER.

ACCOMPANIED BY AN ENGRAVING, PLATE II.

Extract from Specification.

FIGURE 1, plate 2 is a vertical section of the apparatus, figure 2 is a plan of figure 1. A is the tube leading from the steam boiler, B is the stop cock to shut off the steam when not required. C the tube which I call the vacuum tube. D and E tubes through which the air flows. F the tube into which the steam passes in its escape to the chimney or into the open air, it is also through this tube that the air passes; *a* represents the openings for the steam in the pipe. F, shewn in section at figure 3, two of these openings are circular, parallel and concentric; the two others are plain, and their direction tends to the common centre of the circles, generating from the two others. The sectional form of the tubes may be varied to any form required. The interior diameter of the tube D is equal to from 14 to 15 of that of E, and the diameter of E of 15 to 18 of the tube F.

The size of the opening at *a* is about one-tenth of the size of tube F, these proportions may be varied, but I have found them produce good results in working with a pressure of steam equal to five atmospheres. The pressure may be increased or decreased by the regulation of the opening *a*, X X are the cylinders containing the principal parts used in the apparatus. K is a vacuum chamber, I I pipes communicating between the receiver K and the cylinder X X; M the cock in the pipe C, S T are gauges to ascertain the state of the rarefied air.

Having described the parts, I will now show the manner of putting it into operation. Steam being generated at a pressure of five atmospheres, the two cocks B and M being closed, on opening the cock B the steam will flow through the opening *a*, its continued passage through the tube F carries away the air in the cylinder X X, and produces a partial vacuum in K, the mercury of the gauge T will rise to the height of 50 or 55 centimetres above the cup, then on opening the cock M, the air in the pipe C will rush through the pipes D E without materially altering the state of the partial vacuum in the cylinder X X, and of the chamber K with which it is in communication, and the mercury in the gauge T instead of being depressed will rise some centimetres higher, the state of the vacuum will be indicated by the mercury at 30 centimetres above the cup. With this apparatus you can maintain a constant partial vacuum or removing of air in any recipient. I will now proceed to describe another modification of the apparatus, there being two vacuum vessels used in place of one.

Figure 4 is a vertical section, and figure 5 a plan of the same. A the tube leading to the steam boiler, B the cock to shut off the steam when not required, C the pipe communicating with the apparatus from which atmospheric air is to be withdrawn, D and E tubes through which the air flows, F tube into which the steam flows, and it is also through this tube that the air from the tubes D and E flows with the steam, *a* is the opening for the escape of the steam shown full size at figure B, G tube into which the steam and the air come from the part of the apparatus to be now described; R R is a tube leading to the vacuum chamber O, Q conical tube communicating with the chamber O, through which the air passes into the tube G by the pipe R, H is the escape pipe for the steam and air into the atmosphere, K and L are the air vessels or receivers, I I and Y are pipes connecting the receivers K and L to the cylinders X and P, S T and U are the gauges indicating the different states of the rarefied air, X X and P are the cylinders.

The operation of this apparatus is as follows:—The steam being generated to a pressure of five atmospheres, and the three cocks B M and N being closed, on opening B the steam will flow through the orifice *a*, by the continued action of the steam through the tube the air withdrawn from the cylinder X and the chamber K, and the mercury will rise in the gauge to 50 or 55 degrees above the cup, and there remain. On opening the cock M a constant withdrawing of air will take place with considerable velocity, at the same time the state of vacuum in K X will not be materially altered, and the mercury in the guage T will be raised higher, the continued action of the steam and air through the tube G rarefies the air in the receiver L, and in the cylinder P, and the mercury in the gauge U rises to 40 centimetres above that of its cup, and is kept there on opening the cock N, the air issuing from the chamber in connection with the tube R will flow through the conical tube Q into the tube G, the state of the air in the receiver L and the cylinder P is not at all changed, but the mercury in the gauge S will rise 30 centimetres, fresh supplies of air can be admitted as explained in the description of figures 1 and 2. A third air vessel may be used in a similar manner to the second when required, by admitting the atmospheric air through the pipes R R.

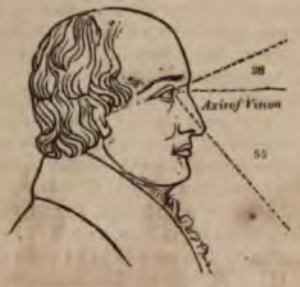
Figure 6 is a plan of the apparatus suitable for raising water from one level to another when worked by either of the apparatus shown in figures 1 to 5. Figure 7 is an elevation of the same, these having been previously described in the preceding drawings, I have not thought it necessary to repeat the description. Figure 8 is a vertical section of the exhausting or draining machine, from a line drawn from P to Q shown at figure 9. Figure 9 is a plan of the stage No. 1, as shown at figure 8, from a line drawn from N to O; S S S are the receivers placed one above the other at equal distances. T T T are the ascending tubes terminating in the receiver S; the lower part of the tube T of the stage No. 1 is placed on the well or other source of water Y Y, and the lower parts of the other tubes are placed in the receivers S. The number of these stages may be increased or decreased according to the height that the water is required to be raised. At the top of each of the ascending tubes T there is a valve Y; Z is the tube through which the air is withdrawn, the lower end of the tube is open and plunged in the water of the well Y Y, it is connected with the pneumatic apparatus by the tube K, and with the recipients S S S, by the small tubes U U U; X X X are the floats, and V V V are the air valves. In the top of the upper receiver S is attached a bent discharge tube W, closed by a valve W'; R is the reservoir for the water when raised, Æ shows where a pipe may be fixed to conduct the water to any place required.

To put this machine into operation, the cock E, figures 6 and 7 of the apparatus, is to be opened, the air and steam flowing into the atmosphere by the tubes F F, and the mercury of the gauge I will rise to 50 or 55 centimetres above its cup. The cock L is then opened, and the air contained in the interior of the exhausting machine will flow through the tube K across the pneumatic apparatus with great speed, at least 200 centimetres per second, and will flow into the atmosphere with the steam. The discharge of the air across the apparatus does not in any way affect the state of the vacuum, as may be ascertained by the mercury in the gauge I always remaining at the same height. The height of the mercury in the gauge M will always indicate the state of the air contained in the exhausting machine when it is about 31 or 32 centimetres; the receiver S of the stage No. 1 is full of water drawn from the well Y Y, the float X will then raise the small valves V V, and close the orifice U for the discharge of the air against which it will be held fast, the atmospheric air being admitted through the small openings of the valves V, the valve Y closes, and the pressure on the water in the receiver forces it up into the receiver S of the stage No. 2. The same operation is performed in the stages No. 2 and 3 as that described with regard to No. 1, it is not therefore necessary to repeat the description. The air valves of the stages No. 1 and 3 are opened by their floats at the same time that they are closed in the stage No. 2, they will then be restored to their original position. The water when raised to the upper receiver at the stage No. 3, flows through the tube W into the large reservoir R, and the valve W′ is raised to allow it to pass freely, during this time the water again flows into the receiver of the stage No. 1. Besides this tube W in the receiver S of the stage No. 3, there is another which is not shown in the drawing, the object of it is to regulate the opening of the valve by means of a screw, in order to regulate the flow of the water in such manner that the float X shall press against the air escape pipe, at the same time that the float of the stage No. 2 raises its air valves, and the float of the stage No. 1 presses against the opening of the air escape pipe. In order that the floats should properly perform the functions that are assigned to them, they must be so constructed that the power which they require by the quantity of water displaced, will be sufficient to raise its proper weight, and to overcome the resistance which the pressure of the air exercises upon the air valves, and the weights of these same valves, and also that when the receivers are empty, their weight allowing for the part which is sustained by the water in the tube in which they are placed, will be sufficient to overcome the resistance of the pressure of the air, which keeps it pressed against the opening of the air escape pipe. The air escape pipe Z Z is placed in the water of the well Y Y, in order that if the water in the receiver (S S S) should flow into it through the tube U U, it may fall down into the well. This machine may also be worked by using any number of air vessels that may be required.

ARTESIAN WELL.—The boring instrument now at work for the Artesian well in the abattoir at Grenelle has reached the depth of 508 metres, or 1,666¼ feet. The earth brought up is still a greenish clay. It requires 4 horses and 12 men to keep the apparatus in action; and it is daily hoped to see water burst up. The temperature increases a degree in warmth for every 30 yards penetrated downwards.

REVIEWS.

Repton's Landscape Gardening and Landscape Architecture, a New Edition. By J. C. LOUDON, F.L.S. London: Longman and Co., 1840.



HUMPHRY REPTON.

Humphry Repton was born at Bury St. Edmond's, May 2d, 1752, of a respectable family, and was originally intended for trade. At an early period he was thrown into contact with the Hopes of Amsterdam, a circumstance which perhaps decided the natural bent of his mind, and confirmed that love for the arts which forbade any other pursuit. After a long contest against his favourite studies, about 1788 he decided upon adopting the profession of a Landscape Gardener, a title which he created and maintained against those who decried its novelty. What was his success in this career it is unnecessary for us to mention, England abounds with his works, and he has left behind him a name which will live when the traces of his labours have vanished. His personal character powerfully influenced him in his artistical career, mild and amiable in his disposition, the same feelings seemed to influence his designs. Grandeur perhaps he rarely attained, but in producing scenes of cultivated and placid beauty, speaking at once of comfort and of wealth, he stood without a rival. He seemed as it were the genius born for cultivating the gentle slopes, and verdant meads of the sea-girt island, ever inspired with that love of the beautiful in nature, which marks the English character, fertile in expedient, he waged perpetual battle against the rude and unpicturesque, and powerfully contributed towards promoting that taste in landscape which has rendered this country the model of surrounding nations.

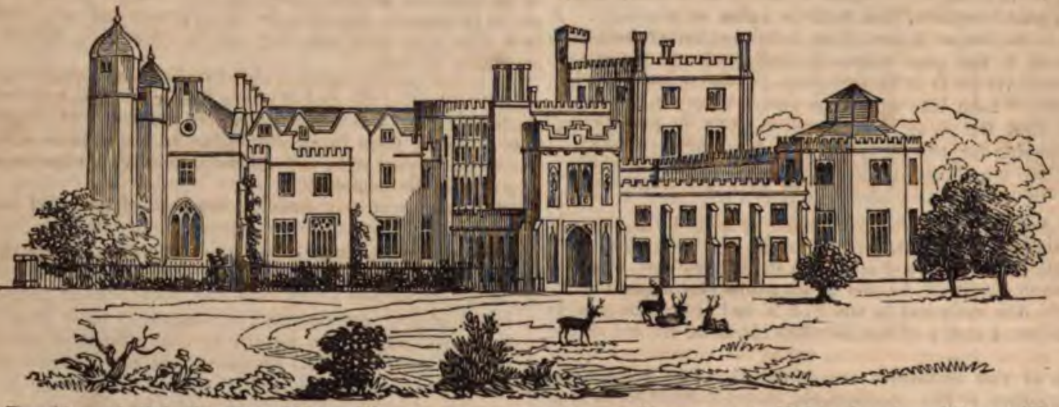
Repton's works consist of an agglomeration of fragments dispersed over one folio and three quarto volumes, now, however, collected by Mr. Loudon into one volume octavo. The service which Mr. Loudon has rendered by this task, cannot be too highly appreciated by the public, for he thus codified (as Bentham would have called it) the most valuable materials on the theory and practice of the art. Throughout these works a continual flow of originality of thought and beauty of idea seems to run from the pencil and pen of Mr. Repton, while the manner in which he exhibits its own personal interest in the subject give such a tone of identity as to resemble rather the warm breathing words of a professor than the cool notes of a closet writer. Repton is always present before us, and yet, instead of charging him with egotism, we receive him as a kindly guide and instructor. There are few portions of Milton more interesting than that where alluding to his blindness, we are personally introduced to an author whom we admire. Thus Repton alludes to some of his grievances.

"I cannot help mentioning, that, from the obstinacy and bad taste of the Bristol mason who executed the design, I was mortified to find that Gothic entrance built of a dark blue stone, with dressings of white Bath stone; and in another place, the intention of the design was totally destroyed, by painting all the wood-work of this cottage of a bright pea-green. Such, alas! is the mortifying difference betwixt the design of the artist, and the execution of the artificer."

"Such is the horror of seeing any building belonging to the offices, that, in one instance, I was desired by the architect to plant a wood of trees on the earth which had been laid over the copper roofs of the kitchen offices, and which extended 300 feet in length from the house."

To show the judicious observations of Mr. Repton relative to the architecture and alterations of old buildings, we select the following extracts from different parts of the work before us, and through the liberality of Mr. Loudon, we are enabled to give a few of the valuable illustrations.

FIG. 2.—ASHTON COURT.



The old part built in the reign of Henry VI.

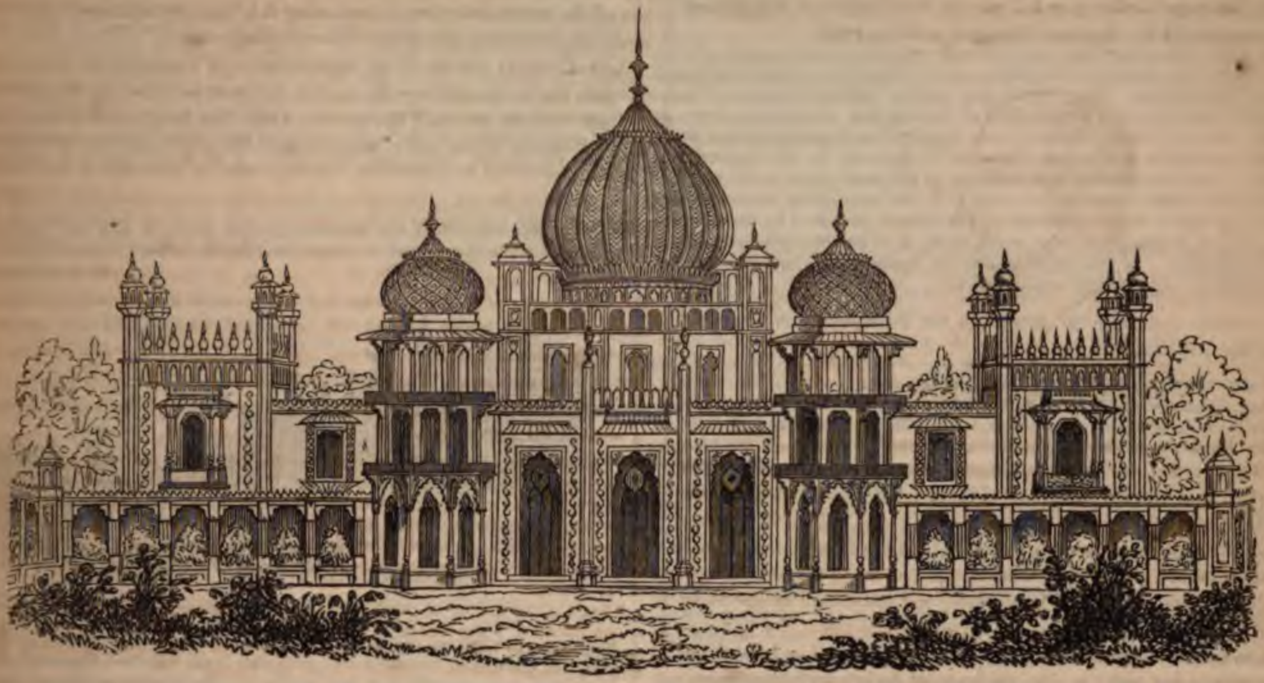
The new part added in the reign of George III.

"The annexed engraving of Ashton Court, fig. 2, furnishes an example of making considerable additions to a very ancient mansion, without neglecting the comforts of modern life, and without mutilating its original style and character.

"This house was built about the reign of Henry VI., and originally consisted of many different courts, surrounded by buildings, of which three are still remaining; in all these the Gothic windows, battlements, and projecting buttresses, have been preserved; but the front towards the south, 150 feet in length, was built by Inigo Jones, in a heavy Grecian style; this front was designed to form one side of a large quadrangle, but, from the unsettled state of public affairs, the other three sides were never added, and the present long front was never intended to be seen from a distance: this building consists of a very fine gallery, which has been shortened to make such rooms as modern habits require; but it is now proposed to restore this gallery to its original character, and to add in the new part, a library, drawing-room, eating-room, billiard-room, with bed-rooms, dressing-rooms, and a family apartment, for which there is no provision in the old part of the mansion. It is also proposed to take down all the ruinous offices, and rebuild them with the appearance of antiquity, and the conveniences of modern improvement.

"A general idea prevails, that, in most cases, it is better to rebuild than repair a very old house; and the architect often finds less difficulty in making an entire new plan, than in adapting judicious alterations: but if a single fragment remains of the grandeur of former times, whether of a castle, an abbey, or even a house, of the date of Queen Elizabeth, I cannot too strongly enforce the propriety of preserving the original character of such antiquity, lest every hereditary mansion in the kingdom should dwindle into the insignificance of a modern villa."

FIG. 3.—WEST FRONT OF THE PAVILION.



Application of Indian Architecture.

"Having already shown the difficulty of adapting either the Grecian or Gothic styles to the character of an English palace, this newly discovered style of architecture seems to present a new expedient for the purpose, in the forms made known to this country by the accurate designs of Mr. Thomas Daniell, and other artists, which have opened new sources of grace and beauty.

"To the materials of wood and stone we have lately added that of cast-iron, unknown in former times, either in Grecian or Gothic architecture, and which is peculiarly adapted to some light parts of the Indian style.

"In Grecian architecture, the artist is confined to five (or, rather, only to three) different orders of columns, so restricted in their relative proportions, that they are seldom used externally, with good effect, in modern houses, and are generally found too bulky for internal use. Indian architecture presents an endless variety of forms and proportions of pillars, from the ponderous supports of the cavern, to the light, airy shafts which enrich their corridors, or support their varandahs. This alone would justify the attempt to adapt a style, untried, for the purpose to which other styles have been found inapplicable or inadequate.

"It is difficult for an artist at once to divest himself of forms he has long studied: this will account for the confusion of Grecian and Gothic in the works of John of Padua, Inigo Jones, and others, about the same date, which occasioned that mixture of style, condemned in after-times for the reasons already assigned. The same thing may be observed in the first introduction of Gothic, mixed with the Saxon and Norman which preceded it: and the same will, doubtless, happen in many instances, during the introductory application of Indian architecture to English uses, while a false taste will both admire and condemn, without any true standard, the various forms of novelty.

"If I might humbly venture to suggest an opinion on the subject, I should recommend the use only of such Indian forms or proportions as bear the least resemblance to those either of the Grecian or Gothic style, with which they are liable to be compared. If the pillars resemble Grecian columns, or if the apertures resemble Gothic arches, they will offend, by seeming to be incorrect specimens of well-known forms, and create a mixed style, as disgusting to the classic observer as the mixture in Queen Elizabeth's Gothic. But if, from the best models of Indian structures, such parts only be selected as cannot be compared with any known style of English buildings, even those whom novelty cannot delight, will have little cause to regret the introduction of new beauties.

"On these grounds, therefore, I do not hesitate to answer the question, concerning which I am commanded to deliver my opinion, that the Indian character having been already introduced (in part) by the large edifice at the Pavilion, the house and every other building, should partake of the same character, unmixed either with Grecian or Gothic; and without strictly copying either the mosques, or the mausoleums, or the serais, or the hill-forts, or the excavations of the east, the most varied and graceful forms should b selected, with such combinations, or even occasional deviations and improvement, as the general character and principles of construction will admit."

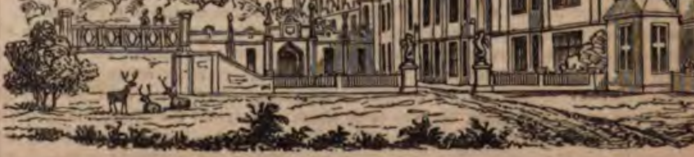
Concerning Cobham.

"Whether we consider its extent, its magnificence, or its comfort, there are few places which can vie with Cobham, in Kent, the seat of the Earl of Darnley; and none which I can mention, where so much has been done, both to the house and grounds. under my direction, for so long a series of years; yet, as the general principles in the improvements originated in the good taste of its noble proprietor, they may be referred to, without incurring the imputation of vanity.

"It is now twenty-five years since I first visited Cobham, where a large and splendid palace, of the date of Queen Elizabeth, formed the three sides of a quadrangle, the fourth side being open to the west. The centre building had been altered by Inigo Jones, who had added four pilastres without any attention to the original style, and without extending his improvements to the two long sides of the quadrangle.

"The interior of this mansion, like that of most old houses, however

Fig. 4—Entrance and north front of Cobham Hall, Kent.



adapted to the customs and manners of the times in which they were built, was cold and comfortless, compared with modern houses. A large hall, anciently used as the dining-room, occupied more than half the centre; and the rest belonged to the buttery and offices, in the manner still preserved in old colleges. The two wings contained rooms, inaccessible, but by passing through one to the other; and the two opposite sides were so disjoined by the central hall, that each was entered by a separate porch.

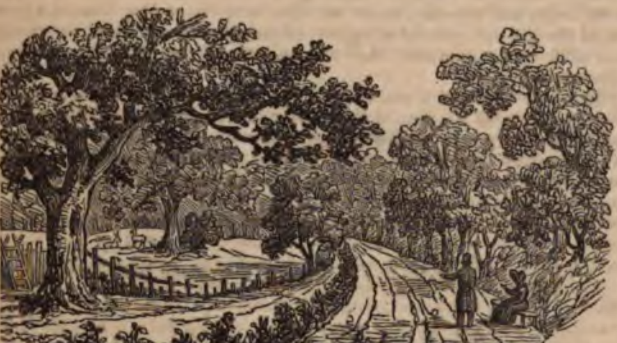
"The great hall at Cobham has been converted into a music-room, of fifty feet by thirty-six, and thirty feet high; and is one of the most splendid and costly in the kingdom. The rest of the central building forms the library, or general living room; which, instead of looking into an entrance-court, as formerly, now looks into a flower-garden, enriched with marble statues and a fountain, forming an appropriate frame, or foreground, to the landscape of the park. The entrance has been removed to the north front, under an archway, or *porte cochère*, over which a walk from the level of the picture gallery (which is up stairs) crosses the road, in the manner described by the annexed sketch, fig. 4, representing the north front, as it has been restored to its original character. In this view is also the bastion, by which the terrace-walk terminates with a view into the park."

We cordially agree with Mr. Repton in the following observations "*Concerning improvements.*"

"I have frequently been asked, whether the improvement of the country, in beauty, has not kept pace with the increase of its wealth; and, perhaps, have feared to deliver my opinion to some who have put the question. I now may speak the truth, without fear of offending, since time has brought about those changes which I long ago expected. The taste of the country has bowed to the shrine which all worship; and the riches of individuals have changed the face of the country.

"There are too many who have no idea of improvement, except by increasing the quantity, the quality, or the value of an estate. The beauty of its scenery seldom enters into their thought: and, What will it cost? or, What will it yield? not, How will it look? seems the general object of inquiry in all improvements. Formerly, I can recollect the art being complimented as likely to extend its influence, till all England would become one landscape garden; and it was then the pride of a country gentleman to show the beauties of his place to the public, as at Audley End, Shardèloes, and many other celebrated parks, through which public roads were purposely made to pass, and the views displayed by means of sunk fences. Now, on the contrary, as soon as a purchase of land is made, the first thing is to secure and shut up the whole by a lofty close pale, to cut down every tree that will sell, and plough every inch of land that will pay for so doing. The annexed two sketches, figures 5 and 6, serve to show the effect of such improvement; they both represent the same spot; formerly, the venerable trees marked the property of their ancient proprietor; and the adjoining forest, waste, or common, might, perhaps, produce nothing but beauty; now the trees are gone, the pale is set at the very verge of the statute width of road, the common is enclosed, and the proprietor boasts, not that it produces corn for man, or grass for cattle, but that it produces him rent: thus money supersedes every other consideration.

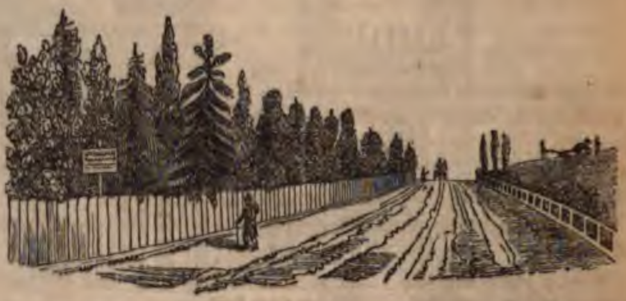
Fig. 5—View from a public road which passes through a forest waste.



This eager pursuit of gain has, of late, extended from the new proprietor, whose habits have been connected with trade, to the ancient hereditary gentleman, who, condescending to become his own tenant, grazier, and butcher, can have little occasion for the landscape gardener: he gives up beauty for gain, and prospect for the produce of his acres. This is the only improvement to which the thirst for riches aspires; and, while I witness, too often, the alienation of ancient family estates, from waste and extravagance, I frequently see the same effect produced by cupidity and mistaken notions of sordid improvement, rather than enjoyment of property. But, to whatever cause it may be attributed, the change of property into new hands, was never before so frequent; and it is a painful circumstance to the professional improver, to see his favourite plans nipped in the bud, which he fondly hoped would ripen to perfection, and extend their benefits to those friends by whom he is consulted.

"In passing through a distant county, I had observed a part of the road where the scenery was particularly interesting. It consisted of large spreading trees, intermixed with thorns: on one side, a view into Lord * * * * 's park was admitted, by the pale being sunk; and a ladder-stile, placed near an aged beech, tempted me to explore its beauties. On the opposite side, a bench, and an umbrageous part of an adjoining forest, invited me to pause, and make a sketch of the spot. After a lapse of ten years, I was surprised to see the change which had been made. I no longer knew, or recollected, the same place, till an old labourer explained, that, on the death of the late lord, the estate had been sold to a very rich man, who had *improved it*; for, by cutting down the timber, and getting an act to enclose the common, he had doubled all the rents. The old mossy and ivy-covered pale was replaced by a new and lofty close paling; not to confine the deer, but to exclude mankind, and to protect a miserable narrow belt of firs and Lombardy poplars: the bench was gone, the ladder-stile was changed to a caution against man-traps and spring-guns, and a notice that the foot-path was stopped by order of the commissioners. As I read the board, the old man said,—'It is very true, and I am forced to walk a mile further round, every night, after a hard day's work.' This is the common consequence of all enclosures: and, we may ask, to whom are they a benefit?

Fig. 6—View after the forest waste had been enclosed, and the ground subjected to agricultural improvement.



"'Adding to riches an increased store,
And making poorer those already poor.'"

Mr. Repton gives the following interesting testimony to his predecessor Brown, whose example he prided himself in following.

"Mr. Brown's fame as an architect seems to have been eclipsed by his celebrity as a landscape gardener, he being the only professor of one art, while he had many jealous competitors in the other. But when I consider the number of excellent works in architecture designed and executed by him, it becomes an act of justice to his memory to record, that, if he was superior to all in what related to his own peculiar profession, he was inferior to none in what related to the comfort, convenience, taste, and propriety of design, in the several mansions and other buildings which he planned. Having occasionally visited and admired many of them, I was induced to make some inquiries concerning his works *as an architect*, and, with the permission of Mr. Holland, to whom, at his decease, he left his drawings, I insert the following list:—

"For the Earl of Coventry. Croome, house, offices, lodges, church, &c., 1751.
The same. Spring Hill, a new place.
Earl of Donegal. Fisherwick, house, offices, and bridge.
Earl of Exeter. Burleigh, addition to the house, new offices, &c.
Ralph Allen, Esq., near Bath, additional building, 1765.
Lord Viscount Palmerston. Broadland, considerable additions.
Lord Craven. Benham, a new house.
"Robert Drummond, Esq. Cadlands, a new house, offices, farm buildings, &c.
Earl of Bute. Christ Church, a bathing-place.
Paul Methuen, Esq. Corsham, the picture gallery, &c.
Marquis of Stafford. Trentham Hall, considerable alterations.
Earl of Newbury. House, offices, &c., 1762.
Rowland Holt, Esq. Redgrave, large new house, 1765.
Lord Willoughby de Broke. Compton, a new chapel.
Marquis of Bute. Cardiff Castle, large additions.
Earl Harcourt. Nuneham, alterations and new offices.
Lord Clive. Clermont, a large new house.
Earl of Warwick. Warwick Castle, added to the entrance.

Lord Cobham. Stowe, several of the buildings in the gardens.
Lord Clifford. Ugbrooke, a new house.

"To this list Mr. Holland added: 'I cannot be indifferent to the fame and character of so great a genius, and am only afraid lest, in giving the annexed account, I should not do him justice. No man that I ever met with understood so well what was necessary for the habitation of all ranks and degrees of society; no one disposed his offices so well, set his buildings on such good levels, designed such good rooms, or so well provided for the approach, for the drainage, and for the comfort and conveniences of every part of a place he was concerned in. This he did without ever having had one single difference or dispute with any of his employers. He left them pleased, and they remained so as long as he lived; and when he died, his friend, Lord Coventry, for whom he had done so much, raised a monument at Croome to his memory.'

"I will conclude this tribute to the memory of my predecessor, by transcribing the last stanza of his epitaph, written by Mr. Mason, and which records, with more truth than most epitaphs, the private character of this truly great man:—

"'But know that more than genius slumbers here;
Virtues were his which art's best powers transcend:
Come, ye superior train, who these revere,
And weep the christian, husband, father, friend.'"

In these last words Repton has written at the same time his own epitaph, so admirably do they describe him as an artist and a man. At the head of this article is a profile of him, with a diagram illustrative of his doctrine of the theory of vision. He died as he had lived, quietly on the 24th of March, 1818, at Harestreet in Essex, his residence during latter years.

The following extract from his description tells in a few words the man and his character.

"Twenty years have now passed away, and it is possible that life may be extended twenty years longer, but, from my feelings, more probable that it will not reach as many weeks; and, therefore, I may now, perhaps, be writing the last Fragment of my labours. I have lived to see many of my plans beautifully realized, but many more cruelly marred: sometimes by false economy; sometimes by injudicious extravagance. I have also lived to reach that period when the improvement of houses and gardens is more delightful to me than that of parks or forests, landscapes or distant prospects.

"I can now expect to produce little that is new; I have, therefore, endeavoured to collect and arrange the observations of my past life: this has formed the amusement of the last two winters, betwixt intervals of spasm, from a disease incurable, during which time I have called up (by my pencil) the places and scenes of which I was most proud, and marshalled them before me; happy in many pleasing remembrances, which revive the sunshine of my days, though sometimes clouded by the recollection of friends removed, of scenes destroyed, and of promised happiness changed to sadness.

"The most valuable lesson now left me to communicate is this: I am convinced that the delight I have always taken in landscapes and gardens, without any reference to their quantity or appropriation, or without caring whether they were forests or rosaries, or whether they were palaces, villas, or cottages, while I had leave to admire their beauties, and even to direct their improvement, has been the chief source of that large portion of happiness which I have enjoyed through life, and of that resignation to inevitable evils, with which I now look forward to the end of my pains and labours."

The few extracts and illustrations we have given, justify us in saying that the mere collation and condensation of such a mass of materials as are contained in the work before us, would be alone sufficient to confer honour on Mr. Loudon, but his merit is still farther enhanced by the admirable manner in which the whole work has been illustrated and improved.

AN INSTRUMENT FOR ASCERTAINING THE AREA OF IRREGULAR PLOTS.

The Committee on Science and the Arts constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination an Instrument for ascertaining the area of irregular plots, invented by Thomas Wood, M.D., of Smithfield, Ohio, Report:

That they have examined the instrument invented by Dr. Thomas Wood, and believe it to be novel and ingenious, and very simple in its construction. It consists of two plates of plain ground glass with their inner surfaces fixed in a frame, so as to be parallel to each other, and only so far distant as to permit a piece of drawing paper to slide easily between them. They are of a rectangular form, fastened on three sides in any manner which shall leave the surfaces parallel. The fourth side being open, the space within is partly filled with pure quicksilver. By means of a slip of drawing paper, the outer edge of the quicksilver is made straight and rectangular with the sides. Its position is then marked. This may be done by noting on the paper used, its distance from the outer and open edge of the glasses.

The plot of any irregular plot made from field notes or otherwise, is then moved in till the quicksilver extends to that point of the plot which is nearest the outer and open edge. The outer edge being now parallel to the former edge by the manner in which the paper containing the plot is cut, its distance from its former edge is measured or marked on the same paper, and the area of the irregular field is thus found to be the difference of the areas of two given rectangles.

The committee see no reason why such an instrument should not, when constructed with proper care, give results as accurate as those obtained by the common method of plotting, and dividing into right angled triangles by the dividers and plane scale. The area of the rectangle of any irregular plot, when once completed, may thus be formed in five minutes, and all danger of mistake from errors in the entries or in summing up the partial areas is completely obviated.—*Franklin Journal.*

DEPTH OF THE SEA.

Dr. Patterson read a paper at the American Philosophical Society, by Professor Charles Bonnycastle, of the University of Virginia, containing Notes of Experiments, made August 22d to 25th, 1838, *with the view of determining the Depth of the Sea by the Echo.*

The apparatus, which is fully described in Mr. Bonnycastle's paper, consisted, first, of a petard or chamber of cast iron, 2½ inches in diameter and 5¼ inches long, with suitable arrangements for firing gunpowder in it under water; secondly, of a tin tube, 8 feet long and 1¼ inch in diameter, terminated at one end by a conical trumpet-mouth, of which the diameter of the base was 20 inches, and the height of the axis 10 inches; thirdly, of a very sensible instrument for measuring small intervals of time, made by J. Montandon of Washington, and which was capable of indicating the sixtieth part of a second. Besides these, an apparatus for hearing was roughly made on board the vessel, in imitation of that used by Colladon in the Lake of Geneva, and consisted of a stove-pipe, 4½ inches in diameter, closed at one end, and capable of being plunged four feet in the water. The ship's bell was also unhung, and an arrangement made for ringing it under water.

On the 22d of August, the brig left New York, and in the evening the experiments were commenced. In these, Mr. Bonnycastle was assisted by the commander and officers of the vessel, and by Dr. Robert M. Patterson, who had been invited to make one of the party.

In the first experiments, the bell was plunged about a fathom under water and kept ringing, while the operation of the two hearing instruments was tested at the distance of about a quarter of a mile. Both instruments performed less perfectly than was expected; the noise of the waves greatly interfering, in both, with the powers of hearing. In the trumpet-shaped apparatus, the ringing of the metal, from the blow of the waves, was partly guarded against by a wooden casing; but, as it was open at both ends, the oscillation of the water in the tube was found to be a still greater inconvenience, so that the sound of the bell was better heard with the cylindrical tube. At the distance of a quarter of a mile this sound was a sharp tap, about the loudness of that occasioned by striking the back of a penknife again an iron wire: at the distance of a mile the sound was no longer audible.

In the second experiments, the mouth of the cone, in the trumpet apparatus, was closed with a plate of thick tin, and both instruments were protected by a parcelling of old canvas and rope-yarn, at the part in contact with the surface of the water. In these experiments the cone was placed at right angles to the stem, and the mouth directed toward the sound. The distances were measured by the interval elapsed between the observed flash and report of a pistol. At the distance of 1400 feet, the conical instrument was found considerably superior to the cylindrical, and at greater distances the superiority become so decided, that the latter was abandoned in all subsequent experiments. At the distance of 5270 feet, the bell was heard with such distinctness as left no doubt that it could have been heard half a mile further.

The sounds are stated in the paper to have been less intense than those in air, and seemed to be conveyed to less distances. The character of the sound was also wholly changed, and, from other experiments, it appeared that the blow of a watchmaker's hammer against a small bar of iron gave the same sharp tick as a heavy blow against the large ship's bell. It is well known that Franklin heard the sound of two stones struck together under water at half a mile distance; yet two of the boat's crew, who plunged their heads below the water, when at a somewhat less distance from the bell, were unable to hear its sound.

On the 24th of August, the vessel having proceeded to the Gulf Stream, experiments were made with the view for which the voyage was undertaken; that is, to ascertain whether an echo would be returned, through water, from the bottom of the sea. Some difficulties were at first presented in exploding the gun under water, but these were at length overcome. The hearing-tube was ballasted so as to sink vertically in the water. The observers then went, with this instrument, to a distance of about 150 yards from the vessel, and the petard was lowered over the stern, about three fathoms under water, and fired. The sound of the explosion, as heard by Mr. Bonnycastle, was two sharp distinct taps, at an interval of about one-third of a second. Two sounds, with the same interval were also clearly heard on board the brig; but the character of the sounds was different, and each was accompanied by a slight shock. Supposing the second sound to be the echo of the first from the bottom of the sea, the depth should have been about 160 fathoms.

To ascertain the real depth, the sounding was made by the ordinary method, but with a lead of 75 pounds weight, and bottom was distinctly felt at 550 fathoms, or five furlongs. The second sound could not, therefore, have been the echo of the first; and this was proved, on the following day, by repeating the experiment in four fathoms water, when the double sound was heard as before, and with the same interval.

The conclusion from these experiments is, either that an echo cannot be heard from the bottom of the sea, or that some more effectual means of producing it must be employed.

Dr. Hare suggested the expediency of employing the Galvanic fluid to fire gunpowder below the surface of water, in experiments similar to those of Professor Bonnycastle.—*Franklin Journal.*

THE SAFETY LAMP.

At a late meeting of the Geological and Polytechnic Society of the West Riding of Yorkshire, Mr. Charles Morton placed on the table a variety of safety lamps, and proceeded to make some observations and experiments upon them. He called to the recollection of the members the attendance of Mr. Fletcher, of Bromsgrove, at one of the former meetings, when that gentleman produced and described a safety lamp constructed on an improved principle. Mr. Fletcher had since modified his lamp in accordance with the suggestions thrown out at that meeting, and the lamp which Mr. Morton exhibited had been sent to him by the inventor for trial in the coal mines. The novelty of the apparatus consists in a door or damper at the top, which is held up by a string tied fast to the lower part of the lamp. If this string be cut or burnt, the damper drops down and extinguishes the light, in the same way as the shutting of the damper on the top of a furnace chimney puts out the fire beneath. When, therefore, the lamp is introduced into an inflammable atmosphere, the combustion of the fire-damp inside burns the thread, and the damper dropping down destroys the flame. Mr. Morton thought the damper would give rise to so much trouble, that the colliers would not use it. The string is not very readily adjusted, and it passes so near to the wick, that a slight inclination of the lamp, or waving of the flame, burns the string, and the falling of the damper leaves the collier in darkness when he neither expects nor desires such a result; and to get rid of this annoyance he would prop up the damper, and effectually prevent its falling, even when it was desirable that it should do so, *i. e.* when it happened to be in a fiery part of the mine. In other respects, this lamp is much like the one invented by Upton and Roberts. The air for feeding the flame enters through the holes beneath, and is brought into immediate contact with the wick by means of a brass cup. The sides of the lamp are partly glass and partly brass, fitted together so as to prevent the admission of air. In Upton's lamp there is a wire gauze cylinder inside the glass, but in Mr. Fletcher's there is none. By this omission the light produced is much stronger, but the safety is materially lessened; for if the glass of Mr. F.'s lamp were accidentally broken, the naked flame would be exposed to the fire-damp, and an explosion would ensue. Mr. Morton stated that he had submitted this new lamp to a variety of experiments, both in and out of the coal mines, and he considered it deserving the attention of this society. He thought the invention was still capable of considerable improvement, and hoped that Mr. Fletcher (though a gentleman entirely unconnected with mining pursuits,) would devote more of his time and talents to the perfection of an apparatus, the ingenuity of which had already entitled him to the thanks of the public. Mr. Morton remarked that the necessity of attempting to improve the safety lamp would become more generally manifest, if it were universally known that Davy's lamp is *not safe* under certain circumstances. When "the Davy" is introduced into an inflammable atmosphere, *at rest*, it may be said to be safe; but if the lamp be in motion, or if a current of fire damp be directed upon it, there is great danger of explosion. By means of a gas jet on the lecture table, Mr. Morton caused the flame of "the Davy" to pass from the inside to the outside of the wire gauze cage; and he contended that, under similar circumstances, an explosion must inevitably ensue in a fiery coal mine; and he had no doubt some of the dreadful catastrophes that have occurred in the pits were occasioned in this manner. Mr. Morton said that the over zealous admirers of Davy had attributed a quality of infallible safety to an instrument which its illustrious discoverer never ventured to claim for it. On the contrary, this distinguished philosopher, in a treatise which he published more than twenty years ago on the subject of the safety lamp, distinctly points out its *unsafety* when introduced into an inflammable atmosphere in rapid motion; and he warns his readers against using "the Davy" under such circumstances. Mr. Morton was of opinion that if the notion which generally prevails about the absolute and certain safety of "the Davy" were dispelled, it would have a tendency to produce greater care and caution among miners. Mr. Morton, in conclusion, directed attention to an apparatus contrived by Mr. W. S. Ward, of Leeds, which he thought might be used for giving light to fiery mines, or in operations with the diving bell. The apparatus consists of a small gas-holder, containing a compressed mixture of coal gas and oxygen. To this is attached one of Hemming's safety tubes and a common jet, at the point of which is placed a ball of quick lime. The kindled flame of gas being directed upon the lime ball, a brilliant light is produced, and as the light is covered with a glass jar, the flame is rendered safe by being completely insulated or cut off from the external atmosphere.—*Midland Counties Herald.*

Windsor Castle.—About five or six weeks since a fissure was observed in the wall at the north-western extremity of the North Terrace, close to the Winchester Tower, the residence of Sir Jeffrey Wyattville. The opening on the northern side extended from the top of the wall to the surface of the earth on the outer side, a distance of some 20 or 30 feet; and on the western side, from the turrets down to the archway entrance to the vaults beneath, which extend under the whole length of the terrace. As soon as the fissure was discovered, workmen were employed to fill up the interstices (or "point" them) with mortar, in order to ascertain if the cracks would go on increasing. Within a very short period after this had been done, the opening not only widened, but extended along the lower pathway, parallel with the Winchester Tower, to a distance of 14 or 15 yards. The fissure now extends to a distance of upwards of 25 yards. Mr. Whitman, the clerk of the works, upon perceiving the dangerous state of the wall. lost no time in communicating with Sir Jeffrey Wyattville, who was then in London, on the subject, by whom the necessary instructions to proceed in such an emergency were immediately forwarded. Upon entering the vaults underneath the terrace, two large cracks were observable commencing from the bottom of the wall on the north side, extending completely across the arch, and terminating at the commencement of the outer wall of the Castle. These fissures were ordered to be "pointed" in the same manner as those on the outer wall, and with the same results; for after a few days the openings were found to be considerably enlarged. The first step determined upon was to ascertain how far from the foundation of the wall the injury extended, and workmen are now employed in digging a shaft within the arched vaults on the northern side for this purpose. As far as they have yet proceeded, so far extends the opening. It is feared, unless some plan be devised before the breaking up of the frost, to secure the immense mass of stonework which is now in so threatening and dangerous a state, that not only will a large portion of the terrace fall down the steep slope by which it is bounded on the north side, but that it will carry with it some thousands of tons of earth into the vale beneath, where is situated some stabling belonging to the canons of Windsor, and close to which is the extensive brewery of Messrs. Reid and Co., late Mr. Ramsbottom's. Some 12 months ago a deep trench or ditch was dug close to the New Terrace-wall, by order of the dean and canons of Windor, (to whom the slopes and a large piece of land on this side belong), for the purpose of receiving the water which runs off the terrace (after rains, &c.) through small gratings, and which, previously to this being dug, ran down the slopes upon their land below. The trench was intended to have turned the course of this water in another direction; but, instead of doing so, it remained in the ditch, where soaked into the earth, and thus, as it is generally supposed, sapped the very foundation of the wall itself, and thence the dangerous state of this part of the terrace, which was erected as long since as the reign of Charles II., who extended it westward upwards of 100 yards.—*Daily papers.*

Adams's Vertebrated Carriage.—On Monday, 10th December last, a vertebrated carriage, constructed according to the patent plan of Mr. Adams, with bow-spring bearers and buffers, for the Birmingham and Gloucester Railway Company, left the station at Euston Square with one of the trains for Birmingham. Much speculation had existed as to its action on the rails, owing to the various peculiarities of its construction, and especially from the circumstance that all four wheels were loose on the axles, in addition to the axles running as usual in the ordinary bearings. It has been hitherto found that carriages with loose wheels are apt to run off the rails at slight curves, but such proved not to be the case with the vertebrated carriage, which adapted itself to all curves with the greatest facility. In fact, it seemed almost impossible for the wheels to run off the rails, as the axles always disposed themselves at right angles to the line of traction, and the lateral yielding of the springs prevented any friction against the flanges of the wheels. Another objection which had been raised against the carriage, by persons connected with railways, was, that though it might be drawn forwards in a train, it could not be propelled, as the joint would yield, and the wheels go off the rails by an angular thrust. This opinion also proved fallacious, as the carriage was found to go equally well either way. The facility of draught was found far greater than that of carriages on the ordinary plan, though much larger than common, consisting of four bodies instead of three. The facility of its movement was strikingly illustrated at the Euston Station, where two of the wheels got off the turn-table, and escaped from the rails. The usual course in such cases is to raise a common carriage by means of screw-jacks, but owing to the action of the joint, and the free movement of the wheels, the vertebrated carriage was rolled upwards by the labourers with little apparent difficulty, without resorting to mechanical aid. We understand that it is intended to run the carriage between London and Birmingham, previous to the opening of the Gloucester Railway, and judging from its satisfactory performance in remedying various railway evils, there seems to be little doubt that this plan of carriage will come into general use. We understand that another improvement by Mr. Adams will shortly be brought forward, consisting of a more perfect lubrication of the axles by means of oil instead of grease, and without the usual waste, so that a carriage will probably run a week with only once oiling. We apprehend that the saving of friction on the wheels, owing to the free revolution independent of each other, will materially increase their durability.—*Railway Times.*

COLLEGE FOR CIVIL ENGINEERS.

In the year 1838, our attention was aroused to a correspondence which had crept into the Times and Athenæum, attempting to lower the character of the profession in this country, and to set up a foreign standard. We rightly surmised that this was a coming event, which cast its shadow before it, that it was the wish father to the thought, which was to usher in some expedient to correct the assumed abuse, and introduce the new doctrine. Accordingly we hastened to attack the new-born hydra, and on repeated occasions expressed our sentiments relative to their new school of error. Remarks upon this subject will be found in volume the first, page 369, and volume the second, pages 13, 86, 124, 152, and 354. On account of this solicitude for the interests of the profession, we were assailed in a violent manner by the advocates of the projected College; what they gained by the attack our readers know.[*] In the meanwhile, the plan has been brought to light, a scheme of operations organised, and active preparations made for carrying them into effect. While the intentions of its managers were not publicly declared, and while they had yet the opportunity of adopting a sane course, and according to the wishes of the profession, we left them to carry on their designs in peace. Now that the mask has been lifted—now that war has been delared against the whole profession, and that an open attempt is made to poison the public mind with error, we feel it our bounden duty to call the serious attention of our readers to the mischievous and fallacious objects, which it proposes to effect. In this investigation, we shall enquire, first, as to the mode of education required by the profession; secondly, as to how far this is supplied; next, as to the merits of the proposed plan; fourthly, how it has hitherto succeeded, and what are its future prospects; and lastly, how far it might be rendered useful.

We have, on previous occasions, already defined engineering,[†] as a profession requiring two distinct faculties, the theoretical and practical, the inventive and the constructive. This is a view sanctioned by the highest authorities. The Report of the Institution of Civil Engineers for 1837,[‡] describes the engineer as a mediator between the philosopher and the working mechanic. In their Report for 1838,[§] they say, "The objects of the Civil Engineer are defined by your charter, and the council considering that the success and permanency of the Institution must depend, in a great measure, on the care exercised in admission into this class, have repeatedly considered this subject with the view of presenting some definite rules for the guidance of themselves and others. It has appeared that they will be aided in this difficult task by adhering as much as possible to the two following conditions; either:—"

"He shall have been regularly educated as a civil engineer, according to the usual routine of pupilage, and have had subsequent employment for at least five years in responsible situations as resident or otherwise in some of the branches defined by the charter as constituting the profession of a civil engineer; or, he shall have practised on his own account in the profession of a civil engineer for five years, and have acquired considerable eminence therein."

"It is thought that the first condition will include those who by regular education have done their utmost towards themselves for the profession, and that their subsequent employment in responsible situations will be a guarantee that they have availed themselves of the opportunities which they may have enjoyed."

"In the earlier days of the science of the civil engineer, such a condition would have been inapplicable; then the force of native genius sufficed to place the individual in that position of professional eminence which commenced with a Brindley and a Smeaton, and was in our own time exemplified in a Rennie and a Telford. To such, of whom there are many illustrious examples amongst us, the second condition is strictly applicable."

The profession, particularly in its present infant state, is ever called upon to provide for unexpected contingencies, to make new precedents, and supersede old processes. The last ten years has seen a new and important branch created, and scarcely established, before it found itself, by new improvements, obliged to abandon all its former calculations, and follow new models. The profession, therefore, is well defined as of two classes, and as uniting two branches of instruction. The accessory portion of instruction is one common to most practical pursuits, and a part of higher education at the same time, consisting as it does, of the mathematical and physical studies, it needs no excathedral inculcation, but admits of being attained by private study by those engaged in the practical department. Like literature, like the arts, it necessarily follows, that its greatest names are not recruited from apprentices to the system, but from every class of society, it admits the collegian and the mechanic; every man, who feels himself called upon by the divine voice to a destined pursuit. Who have been our greatest engineers? not students from a college, or an apprenticeship, but the stone mason and the blacksmith, the labourer and the millwright. Engineering is not like law, bound up in an endless mass of precedents, admitting few new cases, and fearful of diverging from established rules, but it is ever new, ever changing, ever supplanting the past, by anticipations of the future. It does not, like medicine, require the study of a complicated and little known machine, nor a special application of many difficult sciences to its own objects, it does not require mere judgment to apply old rules, but it perpetually encounters new cases, and applies new remedies. The records of its operations are hardly published when they become useless and superannuated; many branches are hardly sufficiently advanced to have any literature at all; consequently, for those seeking practical instruction, the workshop and the field are the only schools; the house cannot be judged by a brick, the sea cannot be measured by a bowl of water, nor can the operations of the engineer be taught on any other scale of truth than on that of the works themselves. The lawyer and the surgeon find no college allsufficient for their instruction, they find not even the court house or the hospital alone efficient, but under the care of the acting practitioner, they are obliged to seek the basis of their education. It is remarkable indeed that a departure should be attempted in this sound course, when other professions are even carrying it to a greater extent; so distrustful are the medical authorities of oral instruction, that they now require at their examinations practical dissections and manipulations.

Engineers may be classified under the following heads:—

1. Civil Engineers—Roads and Railways.[‖]
    Canals.
    Bridges.
2. Mining Engineers—Mines.[¶] Draining.
3. Marine Engineers[**]—Ship Building.
    Harbours.
    Docks.
    Light-houses.
    Dykes.
4. Military Engineers.
5. Practical Engineers—Land Engines.
    Locomotive Engines.
    Marine Engines.
    Manufacturing Engines.

Subsidiary to these are Surveyors, Working Engineers, Locomotive Engineers, and Steam Vessel Engineers. The instruction required for these classes, we consider to be a practical acquaintance with the details of the technical portions, to be acquired under the guidance of practical men in actual operations, and a study of the accessory sciences connected with their pursuits. Ample instruction in the former department is to be obtained from the existing engineers; and with regard to supplementary education, numerous institutions exist, independently of the amount of knowledge communicated by mechanic's institutions and other sources. The Institution of Civil Engineers, and the Universities of London and Durham, and the Military Colleges grant degrees, and classes are formed in London at University and King's College, in those of Norwich, Chatham, Sandhurst, and Addiscombe, and Hanwell Collegiate School; in the Provinces, in the Colleges of Durham and Bath, the Cornish Mining School, the Scotch Naval and Military Academy, at Edinburgh, the Royal Dublin Society's School, at Dublin, the Agricultural School, at Templemoyle, King William College, Isle of Man, and Elizabeth College, Guernsey. The elements of surveying are taught in many of the schools for the middle classes.

We have now to consider the proposed plan of the College for Civil Engineers, which assuming different principles, calculates upon supplanting the existing modes of instruction. These are given to the public in a pamphlet, the confusion and ridiculousness of which, for the present, we pass by unquestioned and unremarked. This prospectus boldly asserts, that with regard to the demand for efficient practitioners in civil engineering, not one of our Universities or public seminaries has kept pace with this want of the age, and afforded a suitable education for the aspirants in that new profession;—the best answer to this is to be seen above. What they mean by the following, they themselves can best explain. "They are, in a great measure, responsible for the profits on our internal industry—on the average of which depend agricultural returns, and also by reaction, an increased demand for labour." The fundamental basis of operations is that the whole instruction, both theoretical and practical, shall be given in the College. This, according to the account of its managers, includes the structure of railways, roads, canals, docks, locks, and harbours, improvement of rivers, clearing mines of water, and their necessary ventilation; the whole structure of the steam engine, land and water transport, architecture and general construction, naval architecture, mining, drainage, embanking, reservoirs, light-houses, arsenals, surveying, levelling, mineral boring, modelling, casting and forging, turning and boring. And what is to feed this multitude?—two loaves and five small fishes—a few professors of mathematics, drawing and latin, an architect, and some acres of ground at Hampstead!!! Is there any one so insane as to attempt to carry out such a scheme?—is there any parent so wasteful of his own money, or regardless of the interests of his child as to entrust him to such a school? In an arena, scarcely fit for a cricket match, are we to see exemplified the wonders of British art; here, by magic processes, are to be reproduced *ad infinitum* the Grand Trunk Canal, the Eddystone Light-house, the Steam Engine, the Menai and Waterloo Bridges, and Birmingham Railway, with its vallied cuttings, its Kilsby tunnels, and its hilly embankments. The Clifton Bridge would span the ground, the Camden Town Embankment, swallow up the soil, and the cutting to Euston Square take in the whole estate. "Philosophy in sport, made science in earnest." We are either to believe these delusions, or we must recognise the sad reality, children mis-spending their father's money and their own time on mimic railways, and gutter canals; expert in all the verbiage which a well disciplined memory can retain, and going out into the world the children which they came into the college. If this be the offspring of the Polytechnic School, an Institution which has flourished under some of the noblest men in France, we believe that, with indignation, they will disavow their bantling; if it be an imitation of Russia, it is an imitation rather of the barbarism, than of the grandeur of that nation; we know that no example in favor of it exists in any other country. In the workshops, South Wales, Birmingham, Glasgow and Newcastle are to be united; the steam engine is to be wrought, by boys, from the native ore into all its wonderful applications as a motive power. What more they profess to teach we know not, we know that all these things, even if practicable as toys, will fail to make engineers such as England has and England wants. The ignorance of the projectors is only equalled by their absurdity; the manner in which the design is to be carried out, is expressed by a synopsis of the course of instruction extending over a peaiod of five years, in the first two years of which the pupils learn nothing of engineering, except surveying and levelling, their principal acquirement being caligraphy; in the second year we find these branches are taught in conjunction with mineral boring and draining, and the principles of Civil and Naval architecture. No progress has yet been made in engineering but never mind, we can wait. The third year advances to shaded and coloured drawing, drainage, embanking, and conduct of running water, and the construction of roads; leaving, consequently, the whole instruction for the last two years. In this course, we find that the principal engineering works (*i. e.* treatises) of the English, French, and Germans are to be read. What those French and German works are we should very much like to know;—to the best of our knowledge very few works exist, except translations from the English. Among the *magna opera* of the last year, we find such terms as "a grand drawing, with plans, sections, and parts in detail;" "grand project for internal transport by land or water, with estimates;" "a memoir on some important question of civil engineering." The pennyworth of bread to these gallons of sack, is the examination and explanation of public works on the works themselves. The "lucidus ordo" of the synopsis must be evident to the most unsystematical; drawing and caligraphy interpolated between mechanics and hydrography; architecture between hydrography and physics, and the same impartial system is carried throughout. As to the workman's class, for which twelve guineas a year is to be charged, the paltriness and inadequacy of instruction given exempts it from notice. The pupils may be admitted into the high school at fourteen years, and on going through the prescribed course of instruction, as any youth of moderate abilities and sufficient memory is sure to do, is turned out on reaching his eighteenth birth-day, a duly qualified successor of Brindley, Smeaton, Rennie, Telford, and Watt.

---

[*] Vol. ii. p. 124.

[†] Vol. i. p. 369, and Vol. ii. p. 124.

[‡] See Journal, vol. i. p. 138.

[§] Vol. ii. p. 73.

[‖] Ingenieurs des Ponts et Chausees, French.

[¶] Ingenieurs des Mines, French.

[**] Ingenieurs des Travaux Maritimes, French. Water Staat, Dutch.

This system, we may observe, is a clumsy imitation of the Polytechnic School, and other similar Institutions abroad, which are adopted in the imperfect state of instruction, to supply the want of a more practical course. In the Polytechnic or Gwerbe School, the student finds those models which he can find with difficulty elsewhere, but under the guidance of a Stephenson or a Maudsley, he learns in that school, which is the model to all Europe. In our pages[*] will be found an account of the state of engineering abroad. What it is here all Europe tells; we boast the names of Middleton, Worcester, Hooke, Savery, Newcome, Brindley, Milne, Smeaton, Bell, Edwards, Arkwright, Rennie, Macadam, Bramah, Huddart, Trevithick, Telford, Woolf, and Murdoch; and among the engineers of the present day:—Walker, Stephenson, the two Rennies, the two Brunels, Cubitt, Locke, Maudsley, Tierney Clarke, &c., many of whom enjoy an European reputation. Such are the fruits of a defective system; what has Europe to show against it? The same defective system prevails in the United States, where gigantic works of the engineers measure the continent from one end to the other.

As to what must be the result of the proposed system, we fear we can augur nothing very good, on one side they are deficient in strength, and on the other side they have to compete with powerful rivals. The plan of the College itself, and its details, have been rendered ridiculous by fantastic absurdities; the very first page of their prospectus is calculated to excite laughter;—a College for Civil Engineers, plastered with the names of a set of Eton schoolmasters, as honorary members; unknown foreigners, as corresponding members; the prospectus is dashed throughout with unmeaning italics; the distinguishing absurdities of the Hone and Black Dwarf School; the vice of those, who wanting strength of thought, make it up by variety of type. One of the professorships is to be held by a clergyman of the church of England, another is the chaplain, and sectarianism is openly proclaimed in a building devoted to the national pursuit of science. Of what religion were the Marquis of Worcester and Watt? "The College is based upon the principles of the established Church." Church of England railways, Catholic steam engines, and Presbyterian canals, whoever heard of such things? Could not the moral and religious instruction of the students be provided for without injuring the feelings of large masses of the population, by giving a preference to a minority? The food of the boarders will be of the best description, and every care taken of their health!—shades of Brindley, Arkwright and Rennie, whoever heard of such superfluous nonsense! "No pupil can be admitted without a certificate that he has had the small pox, or has been vaccinated; and has no particular infirmity or contagious malady." "He must be able to read! and write! fluently, and be master of the first four rules of arithmetic!!" "Corporal punishment will not be permitted in the establishment!" —"Suppose a gentleman designs one of his sons, at the age of five years!!! to be a civil engineer."

As to the supporters of this College, we find many men of high title, but we look in vain for the support of any of the great men, who, by their engineering works, have contributed to their country's glory. Only three names are to be found qualified as engineers, none of whom are sufficient to attract of themselves public support. As to the professors, of whom, by the bye, there are none for engineering, it is saying enough for them to mention, that many of the names are respectable.

We now come to another question of the deepest interest to those parents, who are so ill advised as to send their children to this rickety College, that is, what is to become of the lads when they have got their diplomas? Will they be employed by the present engineers in preference to their own pupils?—will they have greater weight with the public, than men of acknowledged eminence?—will they be supported by the public like those who have received a practical education under first-rate men? Our impression is, that they will not, but that the lads will, after their five years of College education, and an expenditure of several hundred pounds, be obliged to pitch their diplomas into the Thames, and article themselves to those who know something of the profession. We earnestly call on all who may be tempted by the luring proposals of destining children from the cradle, and hatching engineers with more than an Eccaleobion power, to pause and reflect on the waste of time and money which they must incur from any failure of this kind, and to hesitate before they become the victims of a few deluded theorists. So sanguine are the projectors, that they talk of entrapping hundreds of lads, and think nothing of a hundred engineers as the average produce of a year. This, according to our reckoning, would of itself produce three thousand engineers, besides those educated in other establishments;[†] and what is to become of the raw and ignorant youths?—those best will be able to decide, who can coolly give utterance to such preposterous delusions.

---

[*] Vol. i. p. 369.

[†] As to how they are to support the competition of the engineers and existing colleges, its managers may know better than we pretend to do. They will be able to solve whether Everett, Webster, Wallace, and Elmes are equal to De Moran, Silvester, Lardner, and Graham, or to Hall, Moseley, Daniell, Wheatstone, Phillips, Bradley, Cooper, and Tennent.

As to the manner in which they are supported by the profession, it may perhaps be sufficient to refer to the men connected with it, but we have farther public testimonials in the declarations of the Institution of Civil Engineers. The liberality of their opinions we have already shown, so that anything emanating from them, carries with it the whole weight of their character, and is free from the imputation of interested motives. Their Report for 1837,* while advocating the necessity of supplementary instruction, states that much has at times been said respecting the establishment of a School of Engineers, and many comparisons have been drawn betwixt the advantages possessed by this and other countries in this respect, but not for an instant to enter on the great question of the nature of a complete establishment under that name, it may with confidence be asserted, that this Institution is in itself a School of Engineers—a school not in the sense of the term where knowledge is forced upon the unwilling student, but one where the attentive student possesses remarkable opportunities of self-improvement by study and mutual intercourse. In the speech of the President, on opening the Session of 1839,† he calls upon the members to improve themselves, not by collegiate instruction, but by mutual improvement; he says, "there is now upon the table, a prospectus for the establishment, on a large scale, of a College for Civil Engineers," leaving his hearers to form their own opinions upon the merits of such proposition.

That there is room for the establishment of a school of engineering on sound principles, it admits no question; but its sphere, although extensive, is very different from that contemplated by the present plan. Its advocates jump at once to conclusions, inspired by the ardent hope of obtaining large premiums, they jumble everthing together, and mix up the practicable with the impracticable. Stephenson or Brunel carry on no trade in premiums of five hundred guineas, it would make little diminution in their incomes, if they had no pupils at all, but young men are sent to them because from their employment in large works, they have great facilities in affording instruction, and ample means of employing them afterwards. If the council of the College want to know what to do with their establishment, we can tell them how it may be made useful to the public, and profitable to themselves and their pupils. Let them require that every pupil in civil mining, marine or practical engineering shall be articled to a practitioner, and let them like University, King's, and Durham Colleges, limit themselves to teaching the theoretical branches. Form a special class for instructing steam vessel engineers, and they may claim a government grant and a class for locomotive enpineers, and railway companies would probably contribute. Educate surveyors, and instruct them in the higher branches of geodesiacal operations, not as planned by the College, merely the rudiments of astronomy, but its application in trigonometrical surveying. Give supplementary education to mining engineers, and train up mineralogists and assayists. Teach like King's College, the literature of manufactures and machinery, but let the pupils study in the factory instead of the toy-shop. Do the same for the manufacturing chemist, London has establishments enough for his practice. Let the Universities or the Institution give the diploma, and limit the College to teaching, and still will be done more than enough for a beginning, and what will amply pay for all expenses.

In concluding these remarks, we cannot too strongly repeat, that parents should hesitate before they compromise the interests of their children, by sending them to this establishment, and we call on its managers to pause in their career, before they have yet excited the open hostility of the profession, and to devote their energies to a useful and rational purpose, before they are crushed by a powerful opposition. We have been influenced by no prejudice against the College or its objects, but we feel that we have best done our duty both to it and our readers, by unsparingly denouncing what we consider an erroneous and inefficient system of education, and a certain delusion to those who have the misfortune to be its victims.

---

* See vol. i. p. 138.

† See Vol. ii. p. 3.

Oxford University.—Few persons are aware that 100,000*l.* was left to the University of Oxford by Michael Angelo Taylor, to build a picture gallery and lecture rooms connected with science and arts. A dispute having arisen between his relatives and the trustees respecting the will, the latter, rather than risk a suit in Chancery, have agreed to take 75,000*l.*, and have begun clearing the foundation for the building. They have removed the old houses at the corner of Beaumont-street, St. Giles's, nearly opposite St. John's college, which is the most central they could meet with.

GENERAL THEORY OF THE STEAM ENGINE.

By Aristides A. Mornay, Esq.

No. V.

On the Action of the Steam in the Cylinder (continued.)

In our last number we demonstrated that the pressure exerted by the steam against the piston may be assumed in practice as equal to its full elastic force; we intend in a future paper to enter into an investigation of the elastic force of the steam at different instants during the stroke of the piston, preparatory to which it will be necessary to inquire into the effects of an arrangement, which exercises a material influence on the elastic force of the steam during a portion of the stroke of the piston when it is adopted: we allude to the *lead of the slide*, which is considered indispensable in Locomotive Engines.

The *lead* is the advance given to the motion of the slide, by which it is caused to shut the eduction port, and open the steam port a little before the commencement of the stroke, and to shut the steam port and open the eduction port a little before the end of the stroke.

In order to explain the reasons assigned for giving a lead to the slide in locomotive engines, we think we cannot do better than quote the following from the description of Stephenson's Patent Locomotive Engine, in Weale's splendid edition of "Tredgold, on the Steam Engine," pages 450 and 451 of the Appendix. "It is found necessary to let the steam on to the opposite side of the piston before the end of the stroke, in order to bring it up gradually to a stop, and diminish the violent jerk that is caused by its motion being changed so very rapidly as five times in a second. The steam, let into the end of the cylinder, before the piston arrives at it, acts as a spring cushion to assist in changing its motion, and if it were not applied, the piston could not be kept tight upon the piston rod. A little lead of the slide is also necessary that the steam may be admitted through the port into the cylinder, and be completely ready to begin the next stroke when the piston is at the end of the cylinder; but so much is not necessary for this.

"The principal advantage gained by giving lead to the slide is in beginning to get rid of the waste steam before the commencement of the stroke; so that when the piston commences its stroke there is but little waste steam before it to resist its progress, the steam beginning to be let out of the cylinder before it has driven the piston to the end of the stroke. This is a very important point in a locomotive, as the resistance or negative pressure of the waste steam upon the piston is very considerable; from the rapidity of the motion, which allows very little time for it to escape, and from the use of the blast pipe, which obstructs its passage. The area of the extremity of the blast pipe is only five square inches, while that of the steam port is eight square inches, requiring the velocity of the steam in the blast pipe to be considerably greater than in the cylinder. The average negative pressure of the waste steam throughout the stroke is 6 lbs. per square inch when running at the usual rate of 25 to 28 miles an hour; and at greater velocities the negative pressure has been found to increase to double that amount and even more."

From the first reason the evil it is intended to remedy by the lead of the slide appears to be, the tendency of the piston to become loose on the piston rod, through the violent jerks caused by the motion of the piston being changed so very frequently as 5 times in a second. We have to ascertain first, the immediate cause of the jerks, secondly, the manner in which they occasion the piston to work loose, thirdly, their force, and lastly, in what manner and to what extent this is diminished by the lead of the slide.

In order to account for the production of these shocks or jerks, we will consider what passes in the cylinder of a locomotive engine, and first on the supposition that the steam acts on the piston with its full pressure to the very end of the stroke, and that it is then shut off and immediately begins to press with its full force on the other side of the piston.

On this head it is necessary to observe that, under the circumstances here assumed, the steam could not, at the instant the piston commences the stroke, press upon it with its full force (that is, with the same force as in the middle of the stroke), on account of the necessity of first filling the steam passage and waste space at the end of the cylinder. But, since the pressure of the steam remaining in these waste spaces does not sensibly exceed that of the atmosphere, while the fresh steam admitted into them has a very great excess of pressure, say 50 pounds on the square inch, the time required to fill them is certainly very much less than that required to fill one hundredth part of the contents of the cylinder, during which time the steam is pressing upon the surface of the piston with a force increasing from the atmospheric pressure to the maximum pressure attained during the stroke. With respect to the gradual opening of the port, that would not of itself affect the pressure of the steam in the cylinder in any degree, since the degree of opening is constantly proportional to the velocity of the piston, by which means the supply of steam is always equal to the demand. This is equally true while the steam-port is being closed in the last half of the stroke. We may therefore be permitted to assume, as above, that the steam presses on the piston with its full force during the whole time that the steam-port is open.

We may also, for the sake of simplicity, assume the motion of the crank to be strictly uniform; for the variations of power are so exceedingly slight in comparison with the energy of the moving mass, on account of the arrangement of the two cranks, that no sensible variations in the velocity of the engine can possibly result therefrom.

Under these circumstances, when the piston has just arrived at the middle of the back stroke, its motion may be regarded for an instant as uniform, since it is changing from an accelerated to a retarded motion; the strain on the key which connects the piston to the piston-rod is therefore equal to the effective pressure of the steam on the piston *minus* the friction of the latter against the surface of the cylinder. But as soon as the piston has passed the middle of its stroke, its motion begins to be retarded, and since the retarding force has to be transmitted from the piston-rod to the piston through the medium of the key which connects them, the latter has to bear the strain of this force in addition to the pressure of the steam on the piston, which it had to bear in the middle of the stroke. This retarding force must evidently increase from the middle to the end of the stroke with the rate of retardation of the piston's motion. The strain at the end of the stroke will therefore be equal to the effective pressure of the steam on the surface of the piston, *minus* its friction, *plus* the greatest retarding force, since the retardation is then the most rapid. At the commencement of the fore stroke, the pressure of the steam is equal on both sides of the piston, and there is consequently no power to move the piston but such a portion of the momentum of the engine as is sufficient to overcome the inertia and friction of the piston. The former requires a force precisely equal to the retarding force at the end of the stroke, so that the strain is suddenly diminished by the effective pressure of steam on the piston *minus* twice its friction; and the remaining strain is gradually, though quickly, taken off by the escape of the waste steam allowing the steam on the other side of the piston to exert sufficient force to accelerate its motion. From the moment when this is the case all the pressure is borne by the conical end of the piston-rod, until it arrives at the corresponding point of the back stroke, from which the strain on the key increases gradually until it attains its maximum at the end of the stroke, as we have already explained.

In locomotive engines, where the steam is used at very high pressures and the pistons are light, the strain due to the retardation of the motion of the piston is very inconsiderable in comparison with that due to the pressure of the steam, as we shall presently prove, when we calculate the intensity of the retarding force; so that comparatively very little increase of strain takes place during the last half of the stroke, this increase being due to the retardation of the piston alone, while the increase during the first half amounts, as we have already mentioned, to the whole effective pressure of the steam; for by the time the piston has passed through the first half of the stroke, the pressure of the waste steam must be reduced very nearly to that of the atmosphere.

The shocks complained of appear therefore to be due, not to the inertia of the piston requiring a considerable force to change its direction, but to the alternate action of the steam on the two sides of the piston producing a strain on one side of the key which reaches its maximum at some point of the *back* stroke, and is taken off entirely during the *fore* stroke.

The mode in which this intermittent strain on the key may cause it to work loose is evidently by the alternate compression and relaxation of its substance; but the effect of this might be prevented by securing the key with a screw in the same manner as the key at the crank end of the connecting rod.

We have said that the chief part of the strain on the key of the piston is due to the pressure of the steam; this investigation would however be incomplete without a calculation of the strain due to the inertia of the piston in consequence of the great variations in its velocity. This strain is evidently equal to the force which would be required to produce a certain acceleration or retardation in the motion of the piston, and an accelerating or retarding force is proportional to the rate of acceleration or retardation which it produces.

Let $V =$ the mean velocity of the piston in feet per minute, $l =$ the length of its stroke, $v =$ its velocity at any given instant, $\lambda =$ its distance from the end of the stroke, $\alpha =$ the angle contained between the crank and the direction of the stroke, and $x =$ the rate of retardation per minute, at the given instant.

Supposing, for the sake of simplicity, that the motion of the crank is strictly uniform (which is very nearly true in reality), and that the connecting rod is infinitely long in comparison with the crank, the circumferential velocity of the crank pin will be $\frac{\pi\,V}{2}$, and we shall have

$$v = \frac{\pi\,V}{2}\sin.\,\alpha,$$

whence we obtain by differentiation

$$d\,v = \frac{\pi\,V}{2}\cos\alpha\,d\,\alpha.$$

The actual distance to be passed through by the crank pin before it arrives at the dead centre is $\frac{l}{2}\alpha$, which divided by its velocity $\frac{\pi\,V}{2}$, gives for the time required to travel that distance

$$t = \frac{l\,\alpha}{\pi\,V},$$

whence

$$d\,\alpha = \frac{\pi\,V}{l}\,d\,t.$$

Substituting this expression in the value of $d\,v$, and dividing by $d\,t$, we obtain

$$\frac{d\,v}{d\,t} = \frac{\pi^2\,V^2\cos\alpha}{2\,l} = \frac{\pi^2\,V^2\,(l-2\,\lambda)}{2\,l^2}.$$

And since this quantity expresses the retardation of the piston per minute, we have also

$$x = \frac{\pi^2\,V^2\,(l-2\,\lambda)}{2\,l^2}.$$

The retardation per minute produced by the force of gravity is about 115,884 feet, which if we call G, we shall have

$$\frac{x}{G} = \frac{\pi^2\,V^2\,(l-2\,\lambda)}{231768\,l^2}.$$

If then we call w the weight of the piston, and W the pressure due to the retardation x, we shall evidently have

$$\frac{W}{w} = \frac{x}{G} = \frac{\pi^2\,V^2\,(l-2\,\lambda)}{231768\,l^2},$$

or the strain on the key of the piston is equal to the weight of the piston multiplied by the quantity $\frac{\pi^2\,V^2\,(l-2\,\lambda)}{231768\,l^2}$.

As an example let $V = 500$, $l = 1{\cdot}5$, and $\lambda = \frac{1}{48}$. Supposing the driving wheels of the engine to be 5 feet in diameter, the speed under these circumstances would be 29·75 miles per hour. The strain W on the key of the piston is required, when the latter has arrived at a quarter of an inch from the end of the stroke, which is the lead usually given to the slide in locomotives. By the preceding equation we have

$$W = w\,\frac{\overline{3{\cdot}1416}^2 \times \overline{500}^2 \times \frac{35}{24}}{231768 \times 1{\cdot}5^2} = 6{\cdot}9\,w.$$

On inspecting the general equation given above, it will be evident that, all other circumstances remaining the same, the value of W varies as the square of the velocity of the piston, and that it increases as the piston approaches the end of the stroke, the strain at the very end being equal to the weight of the piston multiplied by the quantity $\frac{\pi^2\,V^2}{231768\,l^2}$. Under the circumstances assumed in the above example we should therefore have at the end of the stroke

$$W = 7\,w.$$

It likewise appears that, with various lengths of stroke but the same velocity, the strain is inversely as the length of the stroke, when the piston is at proportionate distances from the end.

The same calculation applies, of course, as well to the first as to the second half of the stroke of the piston, and is improperly omitted in the cousideration of the unequal action of the steam on the crank and the effect of fly-wheels; but in these calculations it is not only the weight of the piston, but that of all the alternating parts of the engine, that must be taken into account. In the same manner the strain on the key which connects the piston-rod with the cross head is a multiple of the weight of the piston and piston-rod, and so on for the other joints. It is, however, necessary to deduct first in each case the friction on the piston and other parts which may intervene between it and the joint under consideration.

Since the strain calculated by the preceding method is due simply to the inertia of the piston, it is clear that, in order to find the whole strain, it will be necessary to increase the former by as much as the pressure of the steam against the surface of the piston may exceed that of the waste steam on the opposite side.

We have now to examine the manner in which the force of the shocks is diminished by the lead of the slide, and to what extent this remedy is effectual.

We shall confine our reasoning on this subject to locomotive engines, in which, as we have already observed, the strain brought upon the key of the piston by destroying the momentum of the latter, is very slight in comparison with that which results from the pressure of the steam on the piston, and which the key must necessarily bear during some portion of the stroke; for, supposing the effective pressure of the steam to be 50 pounds on each square inch of the piston, the area of the latter being upwards of 113 square inches when its diameter is one foot, the total pressure of the steam on its surface is more than 5600 pounds, while the strain due to the inertia of the piston, being under seven times its weight; if we suppose this to be 70 pounds, (which we believe to exceed the truth) is less than 490 pounds, or less than one-tenth part of the strain due to the resistance of the load, deduction being made for the friction of the piston. The connecting key of the piston must therefore unavoidably bear a strain of more than 5000 pounds while the steam is acting with its full force, besides that due to the inertia of the piston, which amounts, at one quarter of an inch from the end of the stroke, to 69 seventieths of the maximum strain due to that cause; and, since this is less than one-eleventh of the total strain at the end of the stroke, when no lead is given to the slide, the greatest amount which can be saved by cutting off the steam and admitting it on the opposite side of the piston at a quarter of an inch from the end of the stroke, is no more than one-seventieth of the strain due to the inertia of the piston, or less than one 700th part of the total strain at the moment of cutting off the steam.

It is therefore evident that the sudden jerks experienced by the key which connects the piston with the piston-rod, in consequence of the rapid changes in the motion of the piston, in as far as they are due to the inertia of the latter, do not afford a sufficient motive for giving a lead to the slide; and that this remedy is entirely ineffectual in diminishing them, in as far as they are due to the alternate action of the steam on the opposite sides of the piston, which is the immediate cause of nearly the whole amount of the evil; so that, if the piston could not be kept tight on the piston-rod without the lead, neither could it be with a lead of a quarter of an inch, when the length of the stroke is 18 inches.

Regarding the second reason, namely, that the steam may be admitted into the cylinder, and be completely ready to begin the next stroke when the piston is at the end of the cylinder, we are of opinion that nothing at all is gained in that respect by means of the lead, but that, on the contrary, it is attended with a slight disadvantage. Near the beginning of this paper we observed that, without any lead, a loss of pressure during a very small portion of the stroke ensues from the necessity of filling the waste space at the end of the cylinder with steam at the beginning of the stroke; but this loss is of very trifling amount. By a lead of one quarter of an inch this loss of pressure is avoided, for this gives sufficient time for the waste space to be filled with steam at full pressure by the commencement of the stroke; but by this means the resistance on the opposite side of the piston is increased, during the last quarter of an inch of the stroke, by whatever pressure the steam has acquired at every instant of that portion of the stroke. The amount of resistance so produced is greater than the loss of pressure at the beginning of the stroke resulting from the abovementioned cause when there is no lead. We do not, however, attach any importance to this circumstance, as the whole amount of loss either way is perfectly insignificant; we only mention it to show that the lead of the slide is not requisite, nor even advantageous, for the second reason assigned by the author of the paper above quoted.

With respect to the third reason, we do not think that so much can be gained as the author appears to suppose, yet, if there is any advantage in the lead, it is probably in beginning to get rid of the waste steam before the commencement of the stroke, so that, when the piston commences its stroke, there is but little waste steam before it to resist its progress, the steam beginning to be let out of the cylinder before it has driven the piston to the end of the stroke. Now there is clearly this advantage in beginning to let out the waste steam before the end of the stroke, that, supposing the time occupied in getting rid of the whole of it to be the same as without any lead, the portion of the stroke traversed by the piston during this time is less, because its velocity is on an average less; besides which, the resistance of the waste steam during the first portion of the time, namely, at the end of the previous stroke is thereby avoided, though at the expense of a part of the useful effect ot the steam in the latter part of the stroke: indeed, by as much as the pressure of the waste steam at the beginning of the stroke has been diminished by the eduction port having been already some time open, by so much must its effective pressure have been reduced at the end of the previous stroke. We have also already mentioned the resistance of the steam let on to the front of the piston before the end of the stroke, which of itself nearly compensates the saving of part of the resistance of the waste steam at the beginning.

The preceding reasoning is only intended to prove that there is little or no reason, and certainly no necessity to give a lead to the slide in *locomotive* engines; for other descriptions of engine it is needless to say any thing, as no one would ever think of giving a lead in any but a locomotive engine. It might however be advantageous to give a lead to the eduction only, as by that means the saving of resistance at the beginning, would not be counteracted by the additional resistance of the steam admitted into the cylinder before the end of the stroke.

To return to the action of the steam in the cylinder. The whole effect produced during an indefinitely short period of time is equal to the pressure of the steam on the whole area of the piston multiplied by the distance travelled by the piston during that time, the pressure of the waste steam being considered as a part of the resistance, or total effect. This is true, although at some moments the resistance may appear less than the pressure of the steam, and at others infinitely greater; for the compensation is perfectly made by the momentum of the moving parts, which serve as reservoirs of power, absorbing, as it were, the excess at one time by receiving an increase of velocity, and giving it out again at another time, when the pressure of the steam is inferior to the resistance. But although the pressure of the waste steam is strictly a part of the resistance, yet we shall, in the following investigation, deduct its amount from the gross power of the steam, and consider the balance as the gross power of the engine, which will then be equal to the useful effect, *plus* the friction and other resistances *in the engine*. In our next paper we shall commence this investigation with the low pressure condensing engine, for which the calculation is the most simple, and then extend it to the other varieties of engine.

ARCHITECTURAL COMPETITION.

Sir,—The subject of Architectural Competition is one, which at this moment, should be more than usually interesting to members of the profession. I do not, therefore, hesitate to request your insertion of the following correspondence, which I think, it will be confessed, exposes as unsatisfactory a case as any of those recently so much commented upon.

In the early part of this year, a committee formed for building a new church at Cardiff, advertised for plans, offering premiums of 20*l*. and 10*l*. for the first and second best designs. In conjunction with my partner, Mr. Brandon, I submitted plans, with a specification and estimate. On the 11th June, we received the following letter:—

Cardiff Vicarage, 10th June, 1839.

Gentlemen,—The premium of 20*l*. offered for the best plan and design for a church in this town, having been awarded to you, I have great pleasure in forwarding you from the committee, an order for that amount on the London and Westimnster Bank, of which I shall be obliged by your acknowledging the receipt.

I am, Gentlemen, your very obedient Servant,

T. Stacey, Hon. Sec.

In the course of two or three weeks after the receipt of that letter, we heard it rumoured that a Mr. Foster, of Bristol, was to be employed as *architect to this church*. Being at a loss to reconcile this statement with the announcement that our's was "*the best plan and design*," we wrote to say, that if their subscription fell short of the contemplated amount, we should be happy to submit sketches for a building on a reduced scale. On the 25th June, we received the following letter.

Cardiff, 24th June, 1839.

Gentlemen,—I fear I have been guilty of an omission in my last communication, that has occasioned you some misconception relative to the proceedings of the committee for building the new church here. Had it occurred to me, the most obvious mode of putting you in possession of their intentions, would have been to send you a copy of the resolutions adopted at the meeting at which the first premium was awarded you. And no better mode occurs to me now. I therefore beg to subjoin a copy of that resolution:—

"It was unanimously resolved, that the premium for the best plan be adjudged to Messrs. Wyatt and Brandon, and that the plan and design of Mr. Foster, of Bristol, be adopted by the committee for those of the new church," &c. &c.

Whilst, therefore, the committee adjudged your design to be the best *according to the advertisement*, they thought it preferable to adopt one furnished by a Mr. Foster, of Bristol. I feel now, that this should have formed part of my last letter, but at the moment I wrote, it seemed to me *that my silence would have been interpreted by you as indicative of the resolutions of the meeting.*

I remain, Gentlemen. your very obedient Servant,
T. STACEY, Hon. Sec.

Why Mr. Stacey should have imagined that from "*his silence*," we were to suppose the committee had resolved upon this unusual course, I am unable to guess. We, however, addressed him on the 25th as follows:—

Sir,—We have to acknowledge the favor of your letter of the 24th inst., and to state the fact of our having misconceived the purport of your former letter. When you announced that the committee had adjudged us the "*first premium for the best plan and design*," it never for a moment occurred to us that the committee would take the unusual, and as we cannot help feeling the unjust course of employing another architect. Either our design was the best, *in accordance with your instructions*, or Mr. Foster's was. *If his accommodated* 2000 *persons, and was most applicable to your objects*, we think you did him an injustice in calling our's *the best*. If, on the contrary, our's was really *the best*, why not have done us the justice to believe that we were capable of altering that design, or producing another *quite applicable* to your wants? We cannot but think the resolution of the committee must have passed in forgetfulness of general custom and of the injurious effect *it must* have in competition generally. Surely, no architect of respectability would be found to expend time and money in designs where "the premium" was the only reward, and certainly not in a case where the amount of such premium is insufficient to cover the actual outlay in preparing those designs. It is only the superintendance of a building, which offers credit and remuneration to the architect proportionate to the thought and the anxiety expended on a meritorious design. * * * We beg to assure the committee, that these remarks are not written in a spirit of dictation, for to their decision we must, of course, bow; but it is not the less *our duty* to call attention to that which unexplained, implies either injustice on their side, or a stain on our professional character, for whilst it appears to the public that we have submitted "the best plan and design" you have received, they learn that *our* future services are declined, and an architect employed, *whose design was neither the first or second best.* We trust, therefore, that the committee will at least alter the wording of their resolution.

We have the honor to be, Sir,
Your obedient Servants,
WYATT AND BRANDON.

The following letter acknowledges the receipt of our's of the 25th, and affords the satisfactory information that Mr. Foster is selected for the *highest premium* the committee could give, namely, their employment, because his "plan and design were not in accordance with the terms of the advertisement." This, certainly, is a curious specimen of justice, and will, no doubt, tend to impress upon the minds of future competitors, the *advantages* of strictly adhering to the instructions issued by committees.

Cardiff, June 27th, 1839.

Gentlemen,—I have had the honor to receive the favour of your letter of the 25th, and will not fail to lay it before the committee at their next meeting. But as it is not likely, from the progress of things, that I shall soon have an opportunity of doing so, I beg to state at once, and from myself, that the reason why Mr. Foster's plan and design were not awarded the first premium was, that they were not in accordance with the terms of the advertisement, and therefore it was, that your's were assigned the premium.

I have the honor to be, Gentlemen,
Your very obedient Servant,
T. STACEY.

One or two other letters passed, in continuation of this subject; that from Mr. Stacey, assuring us that the committee had not the least intention of "offering any mark of disrespect, or want of due consideration to the design of Messrs. Wyatt and Brandon, the merit of which they highly appreciate." On the 30th July we addressed Mr. Stacey.

Sir,—We have to acknowledge the receipt of your favor of the 29th inst., communicating the contents of a resolution passed by the Cardiff Church Committee. We regret the necessity of again troubling you upon this subject, but we must, for the last time, repeat our sense of the injustice done us; which, however unintentional on the part of the committee, is not the less apparent. It is only on the *understanding* that *all* the designs submitted shall be tested by the terms and conditions imposed by the advertisement, and that those designs which *do not comply with such instructions shall be rejected*, that architects compete. Unless all the competitors start from the same point, it is impossible that the race can be a fair one. Mr. Foster's plans, it seems, were sufficiently informal to disentitle him to the premium of 20*l*., and yet these informalities are made to disappear, and he is awarded *the first premium, the superintendance of the building*. And the only premium, which in this case, was worthy struggling for. Surely this is not fair play! It was only on the faith, that the architect who received the first premium, would be employed to carry into execution any work the committee might erect, that you received plans at all. It is (unless specially excepted, as in the case of the competition for the Royal Exchange now going on,) the basis of all understanding between committees and competitors—once destroy this, and you put an end to competition. In the case of the Royal Exchange, the premiums offered are 300*l*., 200*l*. and 100*l*., with this clause, "That if the architect who receives the first premium should not be entrusted with the building, he shall receive an additional sum of 500*l*. if his designs are carried into execution. The committee having power to retain the drawings for which the premium is awarded." Now here there is no understanding, and the fact of their considering it necessary to make these conditions, implies that without them architects should not be invited to compete. Under the circumstances of the case, we have no desire to retain the premium *thus* awarded us, and are prepared to return it, upon being informed to whom it should be paid.

We have also to request you will give directions for our drawings being returned; under any circumstances, they are not the property of the committee, and as they are going to build on Mr. Foster's plan, our design can be of no service to them, unless for the purpose of adopting any arrangement or feature of merit they may be thought to possess; a proceeding which we are unable to suppose a committee of gentlemen would sanction.

We have the honor to be, Sir,
Your obedient Servants,
WYATT AND BRANDON.

To this letter, on the 28th November, we received the following reply:—

Cardiff Vicarage, 27th November, 1839.

Gentlemen,—I beg to forward you the following copy of a resolution of the committee appointed for the erection of a new church at Cardiff, passed on Monday the 25th instant.

The secretary having laid before the meeting a letter from Messrs. Wyatt and Brandon, commenting again on the adjudication of the premium for the best plan, it was resolved:—

"That the secretary be directed to return Messrs. Wyatt and Brandon their plans as they desire, and to inform them that the amount of the first premium awarded them, which they decline to retain, may be paid into the London and Westminster Bank, to the credit of the treasurer of the Cardiff New Church Building Fund."

In pursuance of the foregoing resolutions, I forward your plans by this days' mail, carriage paid. I desire you should understand that the committee meeting of the 25th, was the first that has been held since the receipt of your letter of the 30th July, otherwise it would have been replied to earlier.

I have the honor to be, Gentlemen,
Your most obedient Servant,
T. STACEY, Hon. Sec.

Here closes the correspondence. We have received our designs, and the premium has been returned. Mr. B. Ferry, to whom the second premium was awarded, viewing the matter in the same light that we did, remonstrated by letter, against this act of the committee, and informs me, that the replies he received as to the grounds on which Mr. Foster is employed, were "equally unsatisfactory" with our own. It is always difficult in cases where one's own interests or feelings are concerned, to take an impartial and correct view. And possibly this case, which to any eye presents an *inconsistent*, if not an unjust appearance, may have occurred before, and may not be thought to call for the remonstrances we deemed it right to make. Its consideration, however, can do no harm to those who may hereafter engage in competitions, and if, by the course adopted we have tended in however slight a degree to assert the independence and correct feeling of our profession, the end we had in view will be fully realized.

I am, Sir,
Your obedient Servant,
THOMAS HENRY WYATT.

75, *Great Russell Street*, *January* 1840.

REMARKS ON RAILWAYS,

WITH REFERENCE TO THE POWER, &c. TO BE EMPLOYED UPON THEM.

(Continued from page 6.)

Having in the last number of the journal disposed of railways unfavourable to locomotive engines, we will proceed to examine level railways, with reference to the power to be employed on them, as in the former case. I will take an example lest it be said I make the case suit the principle, instead of making the rule apply to the case.

The Sheffield and Rotherham Railway has been completed about eighteen months; it will elucidate my views as well as any other, and because I am better acquainted with it than those at a distance, I will therefore take it as our example. As truth is what I wish to elicit by these remarks, perhaps it will be the clearest way to say at the commencement what I intend to prove; by so doing your readers will be enabled to judge how the arguments which I bring forward bear on the case.

It is that in the example we have taken, and in any similar one, we can have a *cheaper, more efficient and better railway* by having endless ropes, and stationary engines, than by locomotives.

To prove this, it will be necessary to go into calculations; but to make them as short as possible, I will only give the results, reserving to myself the opportunity of giving them at full length, should any of your readers deny their correctness. First, as to "cost of the railway." It is said the Sheffield and Rotherham Railway has cost already £110,000, about £80,000 of which would go for constructing the railway, viz., embankments, excavations, &c., and for permanent rails. It will not, I think, be disputed that the embankments and excavations on this comparatively level country have been made at a cost of at least £33,000 more than they would have done had fixed engines been the moving power; and as some of the engines upon this railway weigh 16 tons, we may safely take off £7,000 from the first cost of the rails and chairs, making, with the sum first mentioned, £40,000 or the railway, would have cost £40,000 less than it has done had fixed engines been the power contemplated. The interest of this sum, at 5 per cent., is £2,000 per annum. So much for the cost of the railway.

We will now go to the second part of our subject, viz., "more efficient." An engine and tender will weigh about 20 tons; suppose we call the engine 50 horse power, we shall have, at 30 miles per hour, a power of $12\frac{1}{2} \times 50 = 625$ lbs., which will take, on a level railway, nearly 56 tons, 20 of which is taken up by the engine and tender, leaving 36 only conveyed by an engine of 50 horse power at 30 miles per hour.

To convey 36 tons by the stationary system, it will require a rope $3\frac{1}{4}$ inches circumference; 2 miles of it would weigh about 4,600 lbs. Messrs. Walker and Rastric take the friction of the rope to be $\frac{1}{22}$ part of its weight; I see no reason to vary from their estimate; but as Messrs. Robert Stephenson and Joseph Locke, whose bias would be against stationary engines, take it as $\frac{1}{12}$ of the weight. I will, in deference to the opinion of these latter gentlemen, take it to be $\frac{1}{15}$, which is about half way between the one and the other; $\frac{1}{15}$ of 4,600 lbs, is 306 lbs. The friction of the train is 403 lbs., together 709 lbs. which divided by $12\frac{1}{2}$, the power of a horse at 30 miles per hour = 56 horse power, or 6 horse power more than the locomotive. But the locomotive would have to get its steam up before working, and there would be fuel in the fire-box when it had arrived at the end of its journey; I shall take it working 5 minutes before and 5 minutes after, which will make, with the 15 minutes in performing the journey, 25 minutes, or what is about the same thing, 83 horse power for 15 minutes.

Though the stationary system requires an engine 56 horse power, yet, as the 72 trains per day, 36 tons at a time would only occupy, in the two miles worked by each engine 24 minutes per hour, it would only be needful to have them 36 horse power. The distance from Sheffield to Rotherham, 6 miles, is divided into 6 stages, requiring an engine at every other stage; but as it would be more convenient to have one at each end, it will require 4 engines. These 4 engines are employed the whole of the 12 hours, without any intermission, in pumping water out of one reservoir into another fixed 40 or 60 feet above it; the water in the upper reservoir is allowed to run over a water wheel as it is wanted to move the trains, which, as before stated, is about 24 minutes in every 60, by which the 36 horse power engine becomes increased to 90 horse power, or there will be as much water pumped in the 60 minutes by the 36 horse power engine as would supply a water wheel of 90 horse power, if there were no waste; but the loss from this cause, and from friction, will be 33 per cent., which will reduce the engine to 60 horse power, or 4 more than is required; it appears, then, we only require engine power of 144 horses. It is hardly likely that 3 trips per hour each way, for 12 hours, would be made by fewer than 6 locomotive engines kept ready all the time, which would be equal to 300 horse power than twice as much as the stationary, and certainly more than four times the expense in fuel, and by using coke instead of coals, and being high pressure instead of condensing engines.

We think the second part of our proposition "more official"—is clearly made out. There remains now the third, viz., "a better railway;" this will be more difficult to prove, it is such a comprehensive term; but we don't fear being able to do so.

If we can travel as fast, or faster, at a smaller expense, injure the rails less, be less liable to accidents, either to the machinery or rails, have no more stoppages from the machinery getting out of order, and have such stoppages as do occur, shorter, and sooner remedied. If we can insure all these at about half the annual expense in repairs, are we not justified in saying we could have a better railway, I will begin with "speed;" in wet weather, on the Sheffield and Rotherham Railway, it is the practice to put sand on the rails, where there happens to be a slight inclination, to make the wheels bite, and so much are the wheels in the habit of slipping on all railways, that Mr. William Vickers, a merchant in Sheffield, who has a good knowledge of mechanics, and is pretty well acquainted with the working of railways, has been induced to take out a patent for the plan of connecting all the wheels together by means of a belt or strap. If they slip they must lose speed, and injure the rails at the same time. With regard to the speed of the stationary plan, it depends upon the speed of the engine, and is only limited by the strength of the materials of which the rope, pulleys, engines, &c. are constructed; and were there no such thing as resistance of the atmosphere there would be hardly any limit to it. Then comes the relative expense at which this can be done. If we increase the speed of the locomotive, the engine and tender will form a much larger proportion of its load than at present, because it will require a greater quantity of fuel and water on account of the increased power of the engine. The engine would have to be made stronger and heavier to take the same load. The rails, chairs, and every thing connected with them would cost more in repairs, because of the increased speed and weight of the engine, and the engine itself would be sooner worn out. While, on the stationary plan, the only difference would be an increase in the power of the engines, greater strength, of rope and pulleys, and an additional wear in the two latter, the rails, chairs, &c. remaining the same.

I find I am getting unnecessarily into the *minutiæ* of the subject. All these things are important, no doubt, but will be wearisome to your readers to go through. I will therefore confine myself to the comparative safety and annual expense of the two systems. The greater the weight in motion, the less it will be influenced or impeded by obstructions, and this will render it more liable to get off the rails at the curves, and make it more difficult to stop. It appears that locomotive trains will always have 20 tons more weight, as already stated, than the stationary system, the conclusion is obvious. The large wheels of the locomotive engine would have a tendency to run off the rails, the ropes of the stationary plan would tend to keep the carriages on. The engine and train being independent of any other, would be in danger of coming in contact with other trains, unless those trains were at a considerable distance, and every collision without great care would throw carriages in the train of one or both of them off the rails, and occasion great delay to say the least of it. The stationary plan might have a hundred trains, a hundred yards of each other, and they would never approach nearer, this needs no comment. In comparing the annual expense of the two, it will not be necessary to ascertain the expence of each, but only where they differ, to estimate the amount of each. The locomotive engines cost about £1,300 each, and if they are fully worked will cost £300 per annum in repairs, or if half-worked £150. (Let Demetrius and the Craftsmen deny this if they can.) We will take them to be half-worked, there would then require 5 engines and one spare engine, making 6 engines in constant work, so that the cost per annum would be $6 \times 150 =$ £900 for repairs. The engines will last not more than nine or ten years. We will take them at 13 per cent. on 6 engines, which will be £1,014; the fuel we will estimate at $1\frac{1}{4}$ per ton per mile, including waste at each end, we shall have to reckon 50 tons moved in this case and not 36, but as the coke and water is consuming, I have reckoned 50 tons, 72 times 6 miles for 312 days, which amounts to 6,739,200 tons conveyed one mile, $1\frac{1}{4}$ lb. per ton on this will be 3,760 tons of coke, which is 14*s*. per ton, the amount of this will be per annum £2,632. I shall take the enginemen, firemen, &c., to be the same in both systems, therefore need not take them into account; the expence, then, of the locomotive system from these three items will be £4,546 yearly.

The stationary plan has 4 engines of 36 horse power each, on the same principle as those in Cornwall, viz., work with 50 lbs. steam, and cut off the steam at one-fifth of the stroke, these engines consume 24 lbs. per hour for horse-power; 12 hours per day, 312 days, it will give per annum about 602 tons at 5s. per ton, or £150 10s.

The ropes will not require renewing oftener than once in twelve months because there are not jerks or stoppages at the stations, the cost of this, after deducting the value of the old, will be £525. The four engines, engine-houses, and machinery, would cost £8,000, at 6½ per cent. would be £520. The annual repairs to boilers, engines, and machinery, taken as by Messrs. Walker and Rastric, including hemp, oil, and tallow, at 14s. 8d. per horse power, will be £105 8s. The interest, wear and tear of pulleys would be £300, oil to pulleys, and men to grease them, £144, all which sums amount to £1,745 18s.

The whole yearly expense of the stationary system amounts to £1,745 18s. The expence of the locomotive system, £4,546, making a difference in favour of the stationary of £2,800 2s., which sum, added to the £2,000 per annum saved in the first cost of the railway, amounts to £4,800 2s. If the saving of £4,800 per annum does not speak to the pockets of the shareholders, nothing I can say will do it. If gentlemen of fortune wish to have railways, let them have locomotive engines upon them by all means to show to their wives and daughters, but if men of sense and men of business wish to have their shilling's worth for a shilling, let them search and see if these things are so.

DIOGENES.

Sheffield.

(To be continued.)

ENCROACHMENTS AND RECESSIONS OF THE SEA.

It appears that the tendency of [illegible] sea to preserve its parallel" has been pointed out in No. 27 of the Journal as the origin of the encroachment and recession of the sea, and that the action of the influx of water is increased in bays in proportion as the projecting point to the westward is greater, while it is assumed that the filling up of bays and cutting of headlands are equal. The meeting of the tides from the Northern and Southern Channels to the eastward of Hastings, renders a reference to the geological facts to the westward most advisable.

The beds of sand, sandy rock, and clay, denominated the Wealden formation, are supposed to dip from Hastings to Beachy Head, and to disappear under the chalk at that point. The outcrop of the highest sand-rock bed is visible from thence to the Sea Houses, East Bourn, but in the interior, the height of the beds above the sea level seems in some proportion to their hardness. Pevensey Castle is placed towards the end of one of these low ridges so formed, and Pevensey Level consists [illegible] the drains of the outcrop of the clay beds and [illegible] of the bottom of the chalk cliffs to the westward. Romney Marsh is sometimes considered as a more modern deposit of silt, its position in some geological maps is in front of that part of the Hastings sand dipping eastward from the [illegible] line near Hastings. [illegible] is said to have successive ranges of beach banks, of a form nearly corresponding with the present coast line. If these [illegible] are [illegible] from Pevensey [illegible] which I [illegible] extensive [illegible] of beach covered with grass [illegible]. The accumulation of beach at Dungeness point, perhaps amounting to [illegible] acres, is at a lower level, and is shown, as [illegible] on which the sea now beats [illegible] its character [illegible] to the mass of beach at Dungeness.

It has been [illegible] that [illegible] beach [illegible] [illegible] [illegible] [illegible] Beckhams.

[illegible] [illegible] [illegible] Romney Marsh and Pevensey Level, [illegible] the same geological [illegible] the accumulation of beach at Dungeness point and Dungeness [illegible]

[illegible] beach [illegible] Hastings [illegible] beach, [illegible] length [illegible] suggests [illegible] [illegible] beach [illegible] geological [illegible]

In reference to the question of [illegible] cutting and filling [illegible] has been shown [illegible] the waves [illegible] in the [illegible] of cliffs and [illegible] the [illegible] the [illegible] shore which are [illegible] and beach [illegible] the whole [illegible] which is high or low, is fringed with a variable quantity of beach, which is driven along the coast in proportion to the diagonal blow of the waves, and consequently the mass is in motion eastward, as due to the mean excess of the westerly over the easterly waves.

The effect of groins is easily seen; the beach is collected on the weather side, while the lee side becomes bare; hence equal waves have a greater cutting effect on the softer materials of the exposed shore or cliff, and less on the side protected by the accumulation of beach, and in their construction, the principle to be regarded is the retardation of the exact quantity of beach requisite for the protection of each spot, allowing its regular passage either way; the groin referred to at Hastings is probably either too large, or too high at the outer end—the result is inevitable, the shore on each side will be overprotected, or overbared, alternately, according to the direction of the wind.

My object has been rather to question the data assumed than to attempt to elucidate this subject by a reference to the numerous elements essential for that purpose, partly with a hope of inducing civil engineers, to measure and record clearly the geological facts which may happen to come under their notice in the course of their professional labours.

E.

ON THE COMPARATIVE POWER OF STEAM ENGINES.

Sir—Though I have read with great pleasure the communication of Mr. Armstrong on the comparative effects of the Cornish and Lancashire system of working steam engines, yet I must object to the accuracy of the estimate of the gross horse power of the East London Water-works engine, and I trust the following observations will induce others to take into consideration the propriety of confining the term Duty to the distinct and definite meaning in which it has been employed in a large mining district for a longer period, than the existence of factory steam engines. His paper is entitled, "On the Comparative Effects;" the table is headed "Comparative Duty;" the pounds raised one foot high per minute ÷ 33,000 are termed "Gross Horse Power," while this same quantity 194 is termed "Net Effective Power," previous to the deduction of one-third for the resistances of the shafting; yet each is actually derived from the same elements, viz. the average steam pressure taken by the indicator in the Lancashire engine, and the supposed gross load — an allowance for "friction of the engine itself" in the Cornish engine × in each case by the space in feet per minute for gross horse power. The gross pressure of steam whether observed or calculated, is equally capable of being referred to the variable time of the consumption of a bushel of coal (94 pounds), but then such a word as Efficiency would be useful in distinguishing it from Duty. See Phil. Trans., 1827.

Duty as introduced by Watt and retained in Cornwall, is founded on different elements, viz. the nett work performed clear of pitwork or shafting resistances ÷ by the source of motion per bushel of coal, it is always calculated, but if the water was measured or weighed, it might be called actual duty; the usual mode of obtaining the load in the shaft is by squaring the pump diameter in inches × by the lift in fathoms × by 2·0454 pounds the weight of a cylinder of water one fathom in length and one inch in diameter; the omission, however, of the two last decimals only affects the three last figures of the duty in millions.

Duty and gross power are hence the extremes, while gross power minus engine resistances and duty plus pitwork or machinery resistances become nearly net power = engineer's horse power, and gross work performed and those at a stated time are equal to each other. The word effect will be found a convenient term to distinguish gross work done from duty. It has always been necessary to ascertain whether the beam leverage is equal, and [illegible] due allowances must be made for the differences [illegible] it will be also convenient to use the word pressure as equivalent to force and force × space as power, while gross and net [illegible] become [illegible] effect and duty.

In the arrangement of the East London Water-works engine, a weight of [illegible] tons is lifted at the outer end of the beam during the in-door stroke [illegible] packing friction, as well as a column of water [illegible] diameter equal to that of the plunger [illegible] the gross load or the resistance or acting [illegible] during the out-door stroke the weight returns and lifts the water [illegible] friction, &c. &c. As friction increases [illegible] water delivery—while the [illegible] the calculated duty of pumping engines [illegible] approximation to the whole work done, [illegible] that might be expected.

In all cases I am inclined to think the pitwork resistances exceed the decrease due to deficient water delivery. There are no data for duty calculation, except by valueless approximations. I shall however submit to public opinion the following estimate of the gross power of this engine, in comparison with that derived from the "Average Steam Pressure, taken by indicator," in the Lancashire factory engine. I conceive the allowance of half a pound per circular inch for the "friction of the engine itself," a quantity scarcely sufficient to overcome the steam or vapour pressure due to the temperature of the water in the condenser.

Weight in-doors 29 ton - - = 64,960 lbs
Stuffing box friction, say - - - = 501
41^2 inches × 1 fathoms × by 2·0454 lbs = 3,439

Gross load in lbs. - - - = 68,900 load for effect.
Quarter of effect load = 1-5th
gross power - - - = 17,224 engine's resistances.

= 86,124 lbs.

Gross steam pressure on the shaft.

In a recent communication by Mr. Wicksteed, relative to the success of the Harvey's and West's patent double beat valve, the pump stroke is stated to be nine feet, and consequently 90 feet of motion at 10 strokes per minute. Taking the gross pressure in the shaft at 86,124 lbs. × 90 feet, = 7,751,160 lbs. one foot high, we have

$$\frac{7,751,160}{33,000} = 235 \text{ gross horse power.}$$

In consequence however of the prevalence of the method among practical engineers of deducting the resistances due to vacuum, imperfections from the observed average indicator pressure, and calling the result average steam pressure (a quantity I should feel disposed to term a worthless mean between gross and nett power of no practical value, and absolutely injurious in tending to mislead in estimates of pounds of water used in the cylinder), it would not be fair to contrast that which is proposed to represent the gross power of a good Cornish engine, until it has been ascertained whether the observed or calculated gross steam power in the Lancashire factory engine has been given.

The error will be in its favour if an allowance is added of $\frac{1}{12}$, perhaps, for this practise, while the engine's resistance, ought perhaps to be taken higher than one-fifth of the gross power to allow for the greater friction of smaller cylinders working at a high power, if required; it appears to me that the one-third allowance should be deducted from the nett power thus obtained, for a duty estimate, giving 20 millions as a rough approximation.

34,754,432
One-twelfth - - - - - = 2,896,202

37,650,634
One-fifth engine resistance - = 7,530,126

30,120,508
One-third shaft-work - - - = 10,040,169

Duty - - - - - - = 20,080,339

My object is to recommend the simple classification here used, subject to any corrections of engine or pitwork resistances, conceiving if attention be called to this subject, it will soon lead to the adoption of correct methods, which will facilitate the connection of theoretical and practical views of steam engines.

I am, Sir,
Your obedient servant,
JOHN S. ENYS.

January, 1840.

Discovery of a Cavern.—As the workmen were employed in blasting the rocks near the foundation of one of the Clifton suspension bridge piers, a day or two since, they discovered a small opening. On its being examined, it was found to lead to a small cavern extending fifty-seven feet below the surface of the ground, nearly in a perpendicular direction. The exploration was made by Dr. Fairbrother, with the assistance of one of the workmen. There were several chambers at intervals, but the descent is difficult, and can only be made with the assistance of ropes. The air is tolerably pure, so that the candle burnt freely during the whole of the time (nearly two hours). At the bottom, the air was found to be excessively hot, so that the perspiration flowed freely. In other respects the cavity presented nothing remarkable, beyond the ordinary appearance of fissures formed by the raising of the strata of lime-stones by some extraordinary convulsions of nature.

THE CORNISH ENGINE,

AT THE EAST LONDON WATER WORKS.

As the above engine is likely to become an object of considerable interest to engineers, we determined upon paying a visit to the Water Works at Old Ford, for the purpose of obtaining correct information as to her dimension and mode of working. On our arrival at the works, Mr. Wicksteed, the engineer to the Company, immediately granted us permission to inspect the engine, and kindly offered to afford any information we might require, and for this purpose, accompanied us on our view, and readily answered every enquiry, explaining at the same time, the general working of the engine. Before proceeding to the details, we must offer our congratulations to the directors of the Company, on the successful performance of the engine, and we feel happy to find that the very large pecuniary saving in fuel annually, by the adoption of the Cornish engine, will amply repay them for the spirited manner in which they came forward to support their engineer against the almost unanimous opinions of the London engineers, who generally pronounced the boasted performances of the engines in Cornwall to be preposterous. Through the kindness of Mr. Wicksteed, we are now enabled to lay before our readers practical data of the economic working of the engine at the East London Water, Works, which we believe, is the first and only Cornish engine that has been yet erected in the metropolis.

The engine was originally intended for a Cornish mine, known by the name of the "East Cornwall," it was designed by Mr. West, a member of the Institution of Civil Engineers; it is upon the same principle as the one designed by the same gentleman, erected at the Fowey Consols Mines, which has for several years past done more duty than any engine in or out of the county of Cornwall, and manufactured by Messrs. Harvey and Co. of Hayle; it was purchased by the East London Water Works Company in 1837, and removed to London and fixed in its present situation by Messrs. Harvey and West, who have, by the superiority of the working of this engine, and the faithful execution of their contract, given most unqualified satisfaction both to the directors and to Mr. Wicksteed.

Dimensions of the Engine.—The diameter of the steam cylinder is 80¼ inches, and length of stroke, 10 feet 3 inches; the steam is generated in the boilers, under a pressure of 35lb. on the square inch above that of the atmosphere, and cut off when the piston has performed about one-third of its stroke, it then expands during the remaining two-thirds, and in the suceeeding stroke is condensed to form a vacuum on the opposite of the piston, to which it passes through the equilibrium valve in the return stroke, the engine being *single acting.*

By the use of the apparatus called a *cataract*, the engine can be made to work from one (or less) to ten strokes per minute, as may be required. According to the calculations of Mr. Armstrong in our last Journal, the power of the engine is equivalent to 206½ horses, and by the statement of Mr. Enys in the present number, 235 *gross* horse power. Mr. Wicksteed, however, informs us that the actual weight lifted is 66,443lbs. an average height of 9 feet each stroke, which is equal to 18·12 horses' power when the engine works one stroke per minute, or 181·2 horses' power at 10 strokes per minute, a velocity which Mr. Wicksteed deems the greatest *this* engine should be worked at.

Dimensions of the Pump.—The diameter is 41 inches, length of stroke 9 feet 4 inches, quantity of water lifted at every stroke 82·5 cubic feet, or about 14¼ imperial barrels, which is a week's average supply for a house. The plunger-pole of the pump, is loaded with about 29 tons over and above the other end of the beam, and this is the weight the engine has actually to lift at every stroke.

We were very much pleased with the quiet action of Messrs. Harvey and West's patent valve, there we felt any perceptible vibration, although we stood close to the pump; we have given the drawings and specification of the valve in another part of the Journal.

The steam is generated in four cylindrical boilers, 27 feet 8 inches long and 6 feet 5 inches diameter, constructed on Mr. West's Cornish plan; the tops of the 4 boilers are covered over with fine ashes, to prevent the loss of heat by radiation. The area of the boilers exposed to the action of the flame and heated air, is very great; and the furnaces are constructed with a large surface of fire grate, in proportion to the coals consumed, for the purpose of adopting the principle of slow combustion, which is here carried out to its fullest extent, so much so, that when the furnace doors are opened, the smoke at times comes out of the furnace doors into the stoke-hole.

We must also state that the steam cylinder is surrounded with a jacket, which is filled with steam from the boilers, and there is another jacket, or casing of boards, the interval being filled in with ashes, 17 to 18 inches in thickness; all the steam-pipes are also well cased with patent felt, or ashes in boxes.

The following particulars will show the working of the engine for 18 weeks, during which period it worked 2,923¼ hours, and made 1,012,353 strokes, at the average rate of 5·77 per minute, it raising 13,982,942 barrels of water, (of 360lbs. each barrel,) 112 feet 6 inches high, with the consumption of 361 tons, 15 cwt., 1 qr., (= 810,348lbs.) of coal of inferior quality, being the refuse or screenings of Newcastle coal, which has passed through a screen of ⅜-inch thick mesh. By adopting the method of slow combustion, they are thus enabled to use the screenings, which costs only 17*s*. per ton delivered, whereas the superior coal required for rapid combustion, would cost 23*s*. or more.

During the same period, a condensing engine of the ordinary construction made by Boulton and Watt, with a cylinder 80 inches diameter and stroke 8 feet, with a pump 27⅜ inches diameter and stroke 8 feet, worked 1,345½ hours made 1,152,424 strokes, raised 5,416,385 barrels of water, and consumed 275 tons, 17 cwt., 3 qrs., (= 617,988lbs.) of coal as above.

The Cornish engine works constantly under the same pressure, while the pressure in the Boulton and Watt engine is constantly varying, never exceeding the former, but on the average, less.

The Cornish engine worked night and day during the above period, with occasional stoppages, while the ordinary engine worked by day only; but the work of two other engines, on Boulton and Watt's construction, which worked night and day during the corresponding weeks of the previous year, was as follows:—They worked for 2,938¼ hours, and made 2,068,430½ strokes each; they raised together 9,309,362 barrels of water, and consumed 568 tons, 1 cwt., (= 1,272,432lbs.) of *best* coal.

Before the Cornish engine was erected, the East London Water Works Company had, in addition to the water-wheels at their Stratford and Lea Bridge Stations, four steam engines, besides an extra one, which worked during the summer months:—viz. two engines of 30-horses power each, which worked 24 hours; and two of about 95 horses power, which worked, upon an average, 12 hours *per diem*, the extra one was of 70 horses power, and worked occasionally in the summer. The consumption of coal amounted to 3,426 tons per annum, which was about £3,700., while the present engines, viz. one Cornish engine, working 24 hours per day, and averaging six strokes per minute, and one large Boulton and Vatt engine, working 60 hours per week, calculating from the 18 weeks' consumption for both engines, the annual consumption will be 1,941 tons, which cost 17*s*. per ton, or £1,649. 17*s*., thus effecting a saving of £2,050. per annum.

If 66,443lbs. be taken as the actual weight lifted at each stroke, (independent of friction and resistance of the engine,) and multiplied by 9 feet, the average length of the stroke of the pump, it will give 597,987lbs. lifted one foot high at every stroke, if this quantity be multiplied by the number of strokes, the engine performed during the eighteen months, and divided by the consumption of the fuel during that period, it will give: $\left(\frac{597,987 \times 1,012,353,}{810,348}\right)$ 747,054lbs., as the *useful effect*, raised one foot high by 1lb. of coal or 70,223,076lbs., by one Cornish bushel of 94lbs. of coal. It should be observed, that the amount of coals herein given, includes the coals used to keep up the steam whenever the engine stopped during the period mentioned.

In order to secure themselves against receiving inferior coal, the Directors have entered into a very peculiar contract (which we would recommend to the notice of other companies) with their coal merchant to supply them with coal of the same quality throughout the year, he guaranteeing that above 73 million pounds of water shall be raised one foot high by the consumption of 94lbs. of coal, which is equivalent to about 2½lbs. per horse power per hour; or in case of the average duty of the coals not amounting to so much, a proportionate reduction is to be made in the amount to be paid to him.

We trust the foregoing statement will prove interesting to the readers of our Journal. We should have been pleased if we could have presented engravings of this engine to our readers, but we do not so much regret the want of them at present, as we should if Mr. Wicksteed had not informed us that he intends to present complete drawings of the engine and boilers to the Institution of Civil Engineers, with a report, as soon as he has obtained some farther facts which he deems of the utmost importance, namely, the actual quantity of water evaporated by a given weight of coals, the quantity of water passing through the cylinder in the shape of steam to produce the effects stated, and in addition also, the same facts as regards a Boulton and Watt engine, that a fair comparison may be made between the two systems of expansion and non-expansion, and also to prove how much is due to the superiority of the boilers (if any), and how much to the mode of *using* the steam when generated.

The system adopted in Cornwall of reporting to the public every month the duty of the engines, has, we have little doubt, led, by exciting emulation, to the perfecting of the expansion engine, and if in other parts of England the same system were adopted, there is no doubt the public would benefit, as well as those manufacturers whose desire it is to make the best engine, and we therefore offer to those interested in the subject to publish in our Journal the reports forwarded to us. We have little doubt of having a monthly report of *the* Cornish engine, and we should like to have reports of others to compare with it.

MEMOIR OF DAVIES GILBERT, ESQ.

(From the West Briton.)

Davies Gilbert, Esq., D.C.L., late President of the Royal Society, was Hon. F.R.S.E., F.A.S., F.L.S., F.G.S., F.R.A.S., President of the Royal Geological Society of Cornwall, Hon. Member of most of the provincial societies in the Kingdom, and of many on the Continent; he was also many years Member of Parliament for Bodmin, our county town, and was truly known as the Father of British Science. He was the only son of the Rev. Edward Giddy, of St. Erth, the representative of the respectable family of Giddy, of Nanteavallan, by Catherine, only daughter and heiress of Henry Davies, Esq., of Tredrea, only survivor of the ancient house of Davies, through whom he was connected with the noble family of Sandys, and that of Noyel of which the well-known Attorney-General was a member.

When a child, his precocious talents were the theme of the extensive circle with which his father, as chairman of Quarter Sessions, associated. His preliminary education was conducted at home; and at a very early age he contracted an intimacy, which continued until death, with the Rev. Malachy Hitchens, vicar of St. Hilary, a gentleman of high and well-deserved celebrity as a mathematician and astronomer, and as editor of the "Nautical Almanac." This acquaintance, without doubt, materially added in determining his mind to mathematical pursuits, in which he was afterwards so greatly distinguished. His academic education was received at Pembroke College, Oxford, to the funds of which he has been a liberal donor.

The introduction of Mr. Watt's celebrated improvement in the steam-engine into the Cornish mines, and the disputes between that great mechanical philosopher and the late Mr. Jonathan Hornblower, of Penryn, as to the economy and mode of applying the principle of working steam expansively, and which has since been carried to greater extent, and with a more remarkable economy of fuel in this county than any where else, early attracted Mr. Davies Giddy's attention; and the various subjects embraced in its perfect development formed a noble field for the employment of his rare mathematical attainments. The expansive action was employed by Mr. Watt in a single cylinder, but Mr. Hornblower used two. It was, however, far more readily made out in theory than it was acknowledged in practice, that by the use of one cylinder only the same mechanical advantage is obtained, avoiding the additional friction which a second cylinder would entail. The plan of Mr. Hornblower was, after a silence of several years, revived by Mr. Woolf: but it seems by general consent and experience, and by universal practice, to be now admitted that Mr. Watt's is the preferable mode.

Mr. Davies Giddy was solicited by the county at large to take an active part in the determination of the duty performed by Mr. Watt's engines—a task for which his genius and inclination peculiarly fitted him; and in conjunction with the late Captain William Jenkin, of Treworgie, he made a survey of all the steam-engines then working in Cornwall.

An indifference to the labours of authorship, provided the results of his inquiries were available to the public without appearing in print, prevented the investigations of these most important subjects from seeing the light in an authentic form until lately; the first of them appears in the Philosophical Transactions of the Royal Society in 1827—the second still more recently.

One of the most laborious and practically useful works which has distinguished that rich storehouse of intellectual wealth, the Philosophical Transactions of the Royal Society, is a paper by Mr. Gilbert, "On the Properties of the Catenary Curve." This fine example of mathematical inquiry was published whilst the celebrated engineer Telford was preparing his materials for the construction of that stupendous national work, the Menai bridge; and it affords one of the finest tributes on record to the labours of the philosopher in his closet, that after the appearance of Mr. Gilbert's memoir. the engineer caused the suspension chains which had been prepared and completed to be again taken in hand and lengthened by about thirty-six feet. The manner in which this magnificent structure has stood, proves that the principles on which it was constructed are perfectly accurate, but that its weight is insufficient to stand the storms to which it is exposed, without a vibratory motion, which is injurious to its stability.

One of the most remarkable incidents in Mr. Gilbert's life was his discovering, patronising, and encouraging the early struggles of Davy (afterwards Sir Humphry), whose introduction to public life, and to other friends, who brought him, his genius, and ability into notice, was due to his active and unvarying friendship. This is, however, matter of history, and most of our readers are acquainted with it.

In 1828 Mr. Gilbert was, by acclamation, called to that pre-eminently honourable station, the chair of the Royal Society, to which his profound learning and scientific researches, no less than his distinguished personal fitness, recommended him beyond every other person as the proper successor of Davy in the chair of Newton. This conspicuous place, at the head of British, and we may say European, science, Mr. Gilbert held, for about seven years, with the highest honour to himself, and the greatest utility to that learned body. It is a case without parallel, and one of which, as Cornishmen, we are justly proud, that we have furnished two succeeding Presidents of the Royal Society. During his Presidency, Mr. Gilbert was a liberal donor to the society's funds, and he extended a large and an enlightened patronage to every object worthy of the illustrious body over which he presided. He resigned the chair in favour of his Royal Highness the Duke of Sussex, who is now succeeded by the courteous and learned Marquis of Northampton.

In his native county, to which he has ever clung with most tenacious affection, in 1814, Mr. Gilbert founded the Royal Geological Society of Cornwall, (with a single exception) the oldest provincial philosophical society in England, and continued to preside over it until his decease; conferring on it an importance which it would not have otherwise attained, and extending its utility where, without him, it would have been unknown. To the other philosophical, literary, and charitable institutions of Cornwall, he was equally a liberal and enlightened patron.

The last literary labour of Mr. Gilbert's long, honourable, and useful life, was editing the "Parochial History of Cornwall," originally commenced by Mr. Hals, and continued by Mr. Tonkin. This work appeared but a year or two since, with copious addenda by the editor, and geological notes by Dr. Boase. It contains a vast mass of curious and valuable antiquarian research, and rich disquisitions on many subjects of the highest local interest. Its effect has, however, been impaired by typographical inaccuracies, which the printer's carelessness has overlooked.

The rare talents, abilities, and application of Mr. Davies Giddy, at an early period of his life, recommended him to the acquaintance of the leading scientific men of the age, and the principal inhabitants of the county; among these was the late Lord De Dunstanville, a nobleman as much distinguished by his discrimination as by his large and munificent liberality. Through his lordship's instrumentality, Mr. Giddy was returned to Parliament for the borough of Bodmin, in 1807, after having sat as member for Helston; and the distinction thus conferred on him through, what we may not improperly term, extraneous means, was continued from an honourable appreciation of his own ability and worth, until the passing of the Reform Bill, in 1832; when his advanced age and increasing infirmities rendered him desirous of avoiding the turmoil of public life, and of retiring into the peace and tranquillity of his domestic circle.

Whilst in Parliament, there were few members more regular and assiduous in their attendance, than Mr. Gilbert; he generally, though not uniformly, supported the Conservative side of politics, but he seldom spoke, and was by no means an active partisan. His great learning and habits of business, recommended him to all parties; and he acted as chairman of a committee on the financial system, in the critical and difficult period when Lord Castlereagh was the ministerial leader in the Commons. The rectification of the national standards of linear dimensions and capacities, which was made a few years since, was undertaken on his motion for an address to the Crown on the subject. The bounty on the export of pilchards was long continued through his active interposition; and, indeed, every subject which in any way affected the interests of his native county, when it came before Parliament, ever found him at his post, an active, ready, and indefatigable advocate of her interests.

We have now seen him an illustrious philosopher, a learned historian, and an enlightened legislator; but the most distinguishing (and if we may use the language without charge of affectation), the most endearing character we have yet to mention, for it would be vain to attempt to describe it—his conversation; it was not brilliant—it was something infinitely beyond and better than mere display; it was a continued stream of the most profound learning and most exalted philosophy, adapted with exquisite taste to the capacity of his auditory, and enlivened with anecdotes to which the most listless could not but listen and learn. His manners were most unaffected, child-like, gentle, and natural. As a friend, he was kind, considerate, forbearing, patient, and generous; and when the grave was closed over him, not one man, woman or child, who was honoured with his acquaintance, but will feel that he has a friend less in the world; enemies, he cannot have left a single one. A Cornishman he was in every good sense of the word; the mention of a Cornish custom, of a provincialism familiar in his youth, would make the aged man young again; the scenes of his early years, tales of times long gone, were poured forth in delightful glowing language, the more touching from its hearty, earnest, unaffected, and simple elegance.

Within a few years of 1810, Mr. Davies Giddy was married to Mary, only child and heiress of — Gilbert, Esq., of Eastbourne, and took the name of Gilbert, instead of his patronymic of Giddy. This alliance brought a considerable accession of fortune to his already considerable paternal inheritance. By this lady, who survives him, he has had several children, but four only are now alive:—a son, John Davies Gilbert, Esq., a daughter, married to John S. Enys, Esq., of Enys, in this county, and two other daughters yet unmarried. Mr. Gilbert's age was, we believe, about seventy-four, and his long, honourable, and honoured life, crowned with peace, riches, and distinction, was in the bosom of his family.

"QUOT NOTOS, TOT HABUIT AMICOS."

WOODEN PAVEMENT.

Extract from Leitch Ritchie's "Glance at Russia in 1835."

The wooden pavement is, I believe, peculiar to St. Petersburg, and merits a description. It consists of small hexagons sawed from a piece of resinous wood, and laid into a bed of crushed stones and sand. These are fastened laterally into each other with wooden pegs; and when the whole forms a plane surface, the interstices are filled with fine sand, and then boiling pitch is poured over all. This pitch, from the porous nature of the wood, is speedily absorbed; and on a quantity of sand being strewed above it, the operation is complete, and a pavement constructed which is found to be extremely durable, and which seems to me to suffer much less injury from the frost than the stone causeway. The honor of the invention is due to Mr. Gourief, and I have no doubt he will ultimately see it adopted in most of the great towns towards the north. It is the custom of the peasantry to cut down the trees at some distance from the root, and thus a great deal of wood will be turned to a useful purpose, which would otherwise only encumber the ground. Every peasant, besides, by means of his axe alone, is able to construct such a pavement; and in Russia, hands are both plenty and cheap.

THE NEW ROYAL EXCHANGE.

In the Court of Common Council, on the 23rd ult., Mr. R. L. Jones brought up the report of the Royal Exchange Committee, which was as follows:—

"To the Right Hon. the Lord Mayor, Aldermen, and Commons
of the city of London, in Common Council assembled.

"We whose names are hereunto subscribed of your committee in relation to the Royal Exchange and Gresham trusts, to whom on the 6th day of August, 1831, it was referred to carry into execution the Act of Parliament for improving the site of the Royal Exchange, in the city of London, and the avenues adjoining thereto, and to report our proceedings from time to time, do certify that we immediately proceeded to carry the provisions of the said act into execution, and directed several notices to be given to the several parties interested for the purchasing of their property required for the site of the new Exchange, and, having received the claims of the respective parties, we duly considered the same, and have great pleasure in being able to report that the whole of such claims, with two exceptions only, have been adjusted; and, for the further information of this Hon. Court, we have caused a statement to be hereunto annexed, setting forth the sums claimed, and the amounts paid or agreed to be paid, for the purchase of the several premises, including the loss and damage incurred by removal, together with the manner in which each claim was settled; all which we submit to the judgment of this Hon. Court. Dated this 23rd day of January, 1840.

"Richard L. Jones.
B. Stubbing.
W. Richardson.
R. Obbard.
James Frisby.
Edward Hickson.
Henry J. Elmes.
Thomas Corney.
Thomas Burton.
William Croucher."

The following is the statement alluded to:

Buildings purchased for the new Royal Exchange and avenues. Estimate 150,000*l*., for which there were 56 claims.

42 cases claimed .	69,263	—Settled by committee at .	38,852
8 ditto for freeholds	107,981	—Referred to surveyors, and settled at . . .	94,136
4 cases claimed .	37,065	—Settled by verdicts at .	12,284
2 ditto not settled .	5,508		
	£219,817		£145,272

UNION WORKHOUSES.

Sir—On my road from Woolwich to London, the other day, I was much struck with the extensive appearance of the long-talked-of new workhouse for this union, which was to be the "*largest and best house*" under the commission. I walked over the whole establishment, and certainly it is the largest and best built house I have seen under the Poor Law Commissioners—the main building being upwards of 420 feet in length, by about 45 feet in depth—in height three floors (with basement under about half), and the ground floor well kept up, standing in an enclosed square acre (of lower buildings and work-sheds) about, 500 feet × 400 feet, with an old looking building in front (north), for board-room and offices; large range of buildings at back (south), for hospital, infirmary, fever wards, &c.; and work-sheds, wash-house, laundry, &c., at ends; upon the whole, presenting rather an imposing appearance—also an improved one—in comparison with the beggarly looking things erected by the Union generally. Mr. Browne, of Greenwich, is the architect, as in all the other houses (or some parties for him) fretted away the interior of this otherwise noble establishment with a great number of little, low, narrow rooms, called wards, which, were it not for a gallery on each floor, running the whole length of the building (near 420 feet), would be exceedingly inconvenient and unhealthy too—notwithstanding the great care that has been bestowed in the arrangement of the ventilation, the supply of water, and the drainage, to the whole establishment, which appears to me to have been very carefully studied and well executed—as well as the water-closets and other internal arrangements generally. Upon the suggestion and under the able superintendance of Mr. Leake, the Guardian Clerk of the Works, unto whom—one of the Guardians of the Board informed me—they were much indebted for his constant attention, great building tact and skill, and the full exercise of his first-rate mechanical and constructive capacities in their service: he is evidently a man very superiorly calculated to conduct large masses of work, as well as their detailed arrangement, and appears to be quite at home in this department of the business. The ground is on an inclination, with gravel bottom and good water; but the site stands awkwardly with the road, seeing the back of the front building before you see its front elevation, which might have been easily remedied, notwithstanding the depth of the ground; however, considering the house is built for about 1150 inmates, at an expense of less than £24,000. It reflects infinite credit both on Mr. Browne who has had much trouble and opposition to contend with; Mr. Jay of London Wall, who has done himself credit in the execution; the Board of Guardians for their spirit in giving an impetus to the large house yet to be built, and all parties concerned in the erection of those truly National Establishments. I would have given you a detailed account but time presses on me, so beg the insertion of this brief notice.

M. N. O.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

GEOLOGICAL SOCIETY.

The first meeting of this society for the session was held on Wednesday evening, the 6th November.

Rev. Professor Buckland, D.D., President, in the chair.

The following communications were read:

A notice of Showers of Ashes which fell on board the Roxburgh, off the Cape de Verd islands, in February last, by the Rev. W. B. Clarke.

On Tuesday, February 4th, the latitude of the ship at noon was 14 deg. 31 min. north, longitude 25 deg. 16 min. west. The sky was overcast, and the weather thick and insufferably oppressive, though the thermometer was only 72. At 3 p. m. the wind suddenly lulled into a calm, then rose from the south-west, accompanied by rain, and the air appeared to be filled with dust, which affected the eyes of the passengers and crew. At noon, on the 5th of February, the latitude of the *Roxburgh* was 12 deg. 36 min. north, longitude 24 deg. 13 min. west; the thermometer stood at 72, and the barometer at 30—the height which it had maintained during the voyage from England. The volcanic island of Fogo, one of the Cape de Verds, was about forty-five miles distant. The weather was clear and fine, but the sails were found to be covered with an impalpable reddish-brown powder, which Mr. Clarke states resembled many of the varieties of ashes ejected from Vesuvius, and evidently was not sand blown from the African deserts. The author also mentions the following instances of similar phenomena, chiefly on the authority of the officers of the *Roxburgh*. In June, 1822, the ship *Kingston*, of Bristol, bound to Jamaica, while passing near Fogo, had her sails covered with a similar brownish powder, which, it is said, smelt strongly of sulphur. In the latitude of the Canaries, and longitude 35 deg. west, showers of ashes have been noticed two or three times. At Bombay, dust, on one occasion, fell on the decks of the vessels to the depth of an inch, and it was supposed to have been blown from Arabia. In January, 1838, dust was noticed by the crew of a ship navigating the China Sea, and at a considerable distance from the Bashee islands, one of which had been previously seen in eruption. In 1812 ashes fell on the deck of a packet bound to the Brazils, and when 1000 miles from land.

A letter from Mr. Caldclough, dated Santiago de Chili, February 18*th*, 1839, containing the declaration of the master and part of the crew of the Chilian brig, *Thily*, of the discovery during the evening of the 12th of February, of three volcanic islands about thirty leagues to the east of Juan Fernandez. The island which was first noticed, appeared, at the time of its discovery, to be rising out of the sea. It afterwards divided into two pyramids, which crumbled away, but their base remained above the level of a violent surge, and in the course of the same evening, the height of the island was, for a time, again considerably increased. The other two volcanic islets bore further southwards. During the night the crew of the *Thily* noticed, at intervals, a light in the same direction.

A letter addressed to Mr. Lyell, by Mr. Buddle, of Newcastle, *On Depressions produced on the Surface of the Ground by the Excavations of Beds of Coal.*

The effects described in this paper are stated to depend on the four following conditions:—

1. The depth of the seam of coal below the surface.
2. The thickness of the seam.
3. The nature of the strata between the seam of coal and the surface.
4. Whether the pillars of coal are wholly or partially removed.

If the depth from the surface does not exceed thirty fathoms, and sandstone forms the greater part of the mass overlying the seam, the subsidence is nearly, if not quite, equal to the thickness of the coal removed; but if "metal stone" or shale constitute the bulk of the beds, the hollow produced by the settling of strata is less. This rule, depending on the nature of the intervening mass, is said to be maintained at all depths. Of the proportional effect produced on the surface, Mr. Buddle has not been able to obtain any accurate information—the amount depending on the four conditions enumerated above; but the depth of the depression depends less on the thickness of the seam than on its entire removal. In the Newcastle pits, where large pillars of coal are left in the first instance, and when these are subsequently removed, blocks or "stooks" of considerable strength are suffered to remain, for the purpose of protecting the colliers from the exfoliation of the roof, the sinking of the superincumbent mass is retarded, and several years sometimes elapse before the excavation is completely closed, or the overlying strata are finally settled down. In the Yorkshire system, by which all the coal, with the exception of small temporary pillars, is removed in the first instance, the roof being supported by wooden presses and stone pillars, the overlying strata subside immediately after the coal is removed.

It is only where water occurs on the surface, or a railway traverses a coal-field, that the amount of depression can be accurately ascertained. In one instance, the removal of a bed of coal six feet thick, one-fourth having been left in "stooks," the depth being 100 fathoms, and the overlying strata principally sandstone, a pond of water accumulated to the depth of rather more than three feet, by the settling of the strata. In another instance, where a railway crossed a district from beneath which three beds of coal had been successively removed, it had been found necessary to restore the level of the railway three times. The aggregate thickness of the seams of coal was nearly fifteen feet, and the depth of the lowest 107 fathoms, of the highest seventy-three, and the mass of the overlying strata consisted of shale. The extent of each settlement was not measured, but the total was 5 feet 6 inches, and this comparatively small amount Mr. Buddle explains by the railway passing near one end of the excavated tract. A still higher seam is now in progress of being worked, and it affords an excellent opportunity for ascertaining the effects produced by the pressure of the superincumbent mass. Innumerable vertical cracks pass through the seam, as well as the pavement and roof, or the beds immediately above and below it, but they are perfectly close except around the margin of the settlement. Along this line the seam is splintered, the pavement and roof are fissured and bent down, and the cracks are frequently open. Within the area of the settlement, the pavement, on the contrary, is as smooth as if it had not been disturbed, the cracks are close, and the coal is not splintered, but rendered tougher, or, in the language of the colliers, more "woody." This effect Mr. Buddle ascribes to the escape of gas by the cracks, and the same changes are sometimes produced by other causes, when the coal is said to be winded.

KING'S COLLEGE, LONDON.

Department of Civil Engineering and Science applied to the Arts and Manufactures.

Regulations in respect to Certificates.

1. The certificates of the second and third years will be of two forms—ordinary certificates, and certificates of honour.
2. No certificate, whether ordinary or of honour, will be granted, which, among the signatures affixed to it. does not include those of the professors of mathematics, mechanics, and chemistry.
3. A certificate of the second year will be necessary to obtaining one in the third.
4. Any student to whom a certificate shall have been refused at the Midsummer examination of any year, may apply for it at the examination of the following Christmas.

5. Every student, desirous of obtaining a certificate in science applied to the arts and manufactures, will be required to present to the examiners the detailed description of some process of manufacturing art, accompanied by the drawings necessary to the explanation of it. This exercise is to bear a certificate of approval from the lecturer on manufacturing art and machinery; and the subject of it is to be appointed by him at least three months before the day of examination.

The certificate of honour will be granted only when this exercise shall have been approved by the lecturer, as the exercise of a candidate for that certificate.

6. Every student applying for a certificate in civil engineering, whether of the first or second years, will be required to present to the examiners finished drawings of the plan, elevation, and section of a machine, made under the eye of the teacher of drawing, and bearing his certificate of approval.

For the certificate of the third year these drawings are to be accompanied by others, showing the details of the machine, drawn in isometrical projection, or in common perspective.

For the certificate of honour in the third year, each candidate will be required to produce, in addition to the above, the geometrical constructions of at least six problems in descriptive geometry.

1. On the intersections of surfaces.
2. On tangent planes.
3. On developable surfaces.
4. On projections of the circles of the sphere.

7. The diploma of associate in the department of civil engineering and science applied to the arts and manufactures, will be granted to such students only as shall have received the certificate of the third year.

8. Only such students as may have received certificates of honour in the third year will be admitted candidates for the diploma of associate of the first class.

9. The examination for the diploma of associate of the first class, will be held at the Christmas which follows the examination of the third year. Every candidate for the diploma of associate of the first class, will be required to present to the examiners, in writing, on the day of examination, the original project of some public work or mechanical contrivance or process of manufacturing art, accompanied by the calculations, drawings, and descriptions necessary to its actual execution, to be specially approved by the lecturer on mechanical art and machinery as the exercise of a candidate for the diploma of associate of the first class, and to bear his certificate to that effect.

ROYAL SOCIETY.

Dec. 12.—Major Sabine, V. P., in the Chair. G. L. Roupell, M. D., was elected a fellow. The following papers were read:—

1. "*On the nerves of the Gravid Uterus*," by R. Lee, M.D.

2. "*Observations made at the Cape of Good Hope, in the year* 1838, *with Bradley's Zenith Sector, for the verification of the Amplitude of the Abbé de la Caille's Arc of the Meridian.*" By T. Maclear, Esq., communicated by Sir John Barrow, Bart.

The author gives an account of the precautions taken in putting together the different parts of the zenith sector, which he received on the 9th of December, 1837, in erecting it in the central room of the Royal Observatory, at the Cape of Good Hope, and in afterwards transferring it to the southern station of La Caille, in Cape Town. He then proceeds to describe La Caille's observatory, and the particular circumstances of its locality, with relation to the object in view—namely, to determine the influence of Table Mountain on the direction of the plumb line. He next relates his progress to Klyp Fonteyn, where he arrived on the 28th of March, 1838; and describes the operations resorted to for erecting the sector at that place. He then enters into the details of observations made at different stations, and especially with comparative observations at the summit and foot of the mountain of Pequet Berg. The instrument was, lastly, conveyed back to Cape Town, and again examined, and the observations made with it repeated. The reduction of the labours occupies the remainder of the paper; and, in conclusion, the author remarks, that, although these labours have not altogether cleared up the anomaly of La Caille's arc, yet they show that great credit is due to that distinguished astronomer, who, with imperfect means, and at the period in which he lived, arrived at a result derived from sixteen stars, almost identical with that from 1139 observations on forty stars, made with a celebrated and powerful instrument.

Dec. 19.—Major Sabine, V.P., in the Chair.

Henry Drummond, Esq., of Albany Park, Surrey, was elected a Fellow.

A paper was read, entitled "*An Account of Experiments made with the view of ascertaining the possibility of obtaining a spark* before *the circuit of the Voltaic Battery is completed.*" By J. P. Gassiot, Esq.

ROYAL INSTITUTION OF BRITISH ARCHITECTS.

At an ordinary General Meeting of the members, held on Monday December 16th, 1839, George Basevi, Jun. V. P., in the Chair, numerous donations were announced as having been received since the last meeting.

Mr. Cottam delivered a discourse on the manufacture of bricks by machinery, illustrated by models, and drawings of the Marquis of Tweeddale's machines for making of bricks and tiles.

January 6.—Thomas Chawner, Fellow, in the Chair.

The following gentlemen were elected: as Fellow, James Penythorne, Architect, of 2, Queen Square, Westminster; as Associate, James Bell, of Wandsworth.

Mr. Donaldson read a paper on the life of Ammanate, Architect of Florence.

January 20.—Edward Blore, V. P., in the Chair.

The following gentlemen were elected: as Fellow, John Crake, Architect, of Old Quebec Street; Associate, F. Ashton, of No. 2, Pelham Crescent.

Several donations were announced as having been received, among which was a donation of 10*l*., by Thomas Chawner, Esq., Fellow.

A highly interesting paper of deep research was read by Edward I'Anson, Jun., on the Temple of Victory, Apteros, at Athens, accompanied by drawings illustrative of its state of restoration in the Spring of 1836.

Mr. Donaldson read a paper by Herr Hallemann, Architect, from Hanover, on the History of Grecian and Russian Ecclesiastical Architecture, illustrated by examples, and an original design

---

MEETINGS OF SOCIETIES IN FEBRUARY.

Institution of Civil Engineers, 25, Great George Street, every Tuesday at 8.

Royal Institute of British Architects, 16, Grosvenor Street, Monday 3rd and 17th, at 8.

Architectural Society, Lincoln's Inn Fields, Tuesday the 25th, at 8.

Society of Arts, Adelphi, every Wednesday at half-past 7.

Royal Society } Somerset House, every Tuesday at 8.
Society of Antiquaries }

PROCEEDINGS IN PARLIAMENT.

HOUSE OF COMMONS.

January 17. *Petitions for Bills presented.*—Arbroath and Forfar Railway; Sheffield and Rotherham Railway Act Amendment; Lancaster and Preston Railway Act Amendment; Chester and Birkenhead Railway; Taff Vale Railway; North Union Railway.

Jan. 20.—Edinburgh and Glasgow Railway.

Jan. 21.—Great Level of the Wash Inclosure.

Jan. 22. *Petitions referred to the Select Committee on Petitions for Private Bills.*—Arbroath and Forfar Railway; Sheffield and Rotherham Railway Act Amendment, referred to Select Committee on Petitions for Private Bills; Lancaster and Preston Railway Act Amendment, petition; Chester and Birkenhead Railway; Taff Vale Railway; North Union Railway; Edinburgh and Glasgow Railway; Glasgow, Paisley, Kilmarnock, and Ayr Railway. Railway Communication.—Select Committee appointed, "to inquire into the state of communication by railways, and to report their observations thereupon to the House:" Mr. Labouchere, Sir Robert Peel, Lord Granville Somerset, Mr. Thorneley, Lord Sandon, Mr. Loch, Mr. Freshfield, Sir John Guest, Lord Stanley, Mr. Greene, Sir Harry Verney, Mr. Henry Baring, Sir James Graham, Lord Seymour, Mr. Easthorpe, Mr. Emerson Tennent, and Mr. French:—Power to send for persons, papers, and records five to be the quorum.

STEAM NAVIGATION.

Steam Navigation.—We are much gratified to perceive the improved condition of seamen generally, and to hear congratulatory accounts on all sides respecting this desirable event. The infusion of young blood of the right quality, in the persons of upwards of twenty-four thousand apprentices, within the last five years, has had a marked effect upon the mass; for some thousands of these having completed their apprenticeship, are now become active able seamen. The number of apprentices reared in steam-vessels—(the General Steam Navigation alone maintain upwards of fifty, principally selected from the Naval Schools at Greenwich)—will become a most valuable class of men; and we have heard that the highly respectable firm of Seward and Co., so celebrated for their success in the manufacture and improvement of steam-engines, have now upwards of three hundred youths indentured as apprentices, with the view of their becoming engineers and assistant engineers in steam-vessels, and fully competent to repair any casualty in the engines that is practicable at sea, without the necessity for returning to port or laying up the vessel.—*Naval and Military Gazette.*

Improved Marine Engines.—A fine new iron steam boat, the property o Lord F. Egerton, or in other words of the Bridgewater Trust, was recently launched from the yard of Messrs. Page and Grantham. She was named the *Alice*, after Lord Francis Egerton's eldest daughter, is about 170 tons burden, old measurement, is neatly fitted up, and is a handsome lively looking boat on the water. With the whole of her machinery, fuel, &c. on board, her draft of water is only four feet six inches. She has two engines of 30 horse power each, made by Messrs. Devonport and Grinrod, of the Caledonian Foundry in this town, upon a novel and improved construction, their peculiarity consists in the fixing of the cylinders on an angle of 45 degrees in the form of a rectangle, with the hypothenuze at the base, so that they act as a stay and support to each other. No side levers *are required or counter balances;* and the working parts being fewer than in ordinary engines, they are less liable to derangement, and not so much exposed to *wear* and *tear*. These engines are exceedingly compact, and have realized all that was contemplated by the ingenious makers—ample power—ease in working, and great strength, combined with unusual lightness. At twelve on Saturday night several gentlemen proceeded in the vessel from the Clarence Dock on a short experimental trip on the river. New engines are necessarily stiff, and it requires some time to ascertain their proper adjustment. With all disadvantages, however, the *Alice* performed her work admirably, from the moment she left the dock. A very short trip only was intended on the first occasion; but the speed of the vessel was so satisfactory, and the gratification of all on board consequently so great, that she proceeded up the river a distance of 12 or 14 miles and back—accomplishing the trip "out and home" in about two hours. On her way up she beat several very powerful steamers, and on coming down successively headed two of the Runnora packets in gallant style. The strokes of the engine averaged thirty-two per minute, but when at her full power they will make thirty-five.—*Liverpool Standard, Dec.* 21.

HALL'S REEFING PADDLES.

"THE inventor is Mr. Hall, the ingenious deviser of the condenser which goes by his name. By a contrivance of the utmost simplicity, all the float-boards of both paddle-wheels of a steam-boat, or either of them, can at any time, or in any weather, be 'reefed' in a few minutes; or, in other words, the diameter of the paddle-wheels be reduced from their extreme size to any other diameter. The advantages which will follow this contrivance are well-known to all persons who have attended personally to steam navigation; but a few words on this point will perhaps not be unacceptable to those who may not have had opportunities of studying the subject afloat under varied circumstances.

Every one can understand that, when a steam-vessel is loaded with a heavy cargo, or has a full supply of coals on board, the paddle-wheels will be sunk to an inconvenient depth in the water, and that, in order to enable them to work with advantage, the float-boards require to be unscrewed and shifted nearer to the centre of the paddle-wheel—an operation of some trouble, and often requiring much time. This adjustment may, of course, be made at the beginning of a voyage, according to the draught of water, but it may become fully as necessary to shift the paddle-boards during the voyage, either farther out or farther in. If the vessel, for instance, by the expenditure of her coals, becomes lighter, the float-boards should be moved out; or, if a gale comes on a-head, they have to be moved in; which operations, if they have to be done in bad weather, are both tedious and difficult. So that any invention which shall give the power of shifting the float-boards easily and quietly, must be of great practical utility, especially on long voyages.

"It is well-known to those who have attended to the subject that no steam vessel can be said to work to the full extent of her power unless her engines make a given number of strokes in a given time—say in a minute; the elasticity of the steam being supposed to continue uniformly of a certain determinate strength. Now occasions constantly arise when, in consequence of the paddle-wheels being too deeply immersed, or that the sea is high, the float-boards are made to impinge on the surface at such an unfavourable angle, and again on leaving it, that a considerable portion of the power is lost in production of what is called back-water. The consequence is, that the paddle-wheel is virtually so over-loaded, that the steam though generated of the proper degree of elasticity is not adequate to turn them round the given number of times. When this happens, as the engine does not make the number of strokes per minute which it ought to do when working at its maximum speed, one of two things must happen, either steam must be blown off and power wasted, or the fire must be lowered in order that no more steam may be generated than the engine, at its reduced number of strokes, can consume. In consequence of this state of things, it happens not unfrequently that vessels whose paddles are too deeply immersed, though carrying a high nominal power, are obliged to work with a power really much inferior.—*United Service Journal.*

The Great Western.—We are happy in being able to say that the examination of this noble vessel since her laying up shows that there is neither spot nor blemish in her, that she does not require caulking or coppering, beyond a few sheets to replace those which have been rubbed off by the coal vessels, or have been removed for the purpose of a thorough examination. All the parts of the engines which are not fixtures have been taken out and thoroughly examined, and are now in progress of replacement. The plan of the directors is to overhaul her completely once a year; and we should say after 35.000 nautical miles steaming per annum, an almost indispensable one, if confidence is to be maintained with the public. We understand that the poop deck is to be lengthened 16 feet; and that the whole of the officers, engineers, stokers, and servants, whose berths below were a great inconvenience and annoyance to the fore cabin passengers, are to be accommodated on deck; also that the fares are to be all equal in the fore and after accommodation, the fore state rooms having been considerably enlarged. She will sail on the 20th of February.—*Bristol Mirror.*

The President Steam-ship.—On Sunday the 5th ult., the Royal William steamer, on her passage from London to Plymouth, fell in with, off the Start, the magnificent steamer President, on her voyage from London to Liverpool, (to take in her machinery), in quite an unmanageable state, having rolled away her foremast, maintopmast, &c. The Royal William took her in tow, and brought her into the Sound during Sunday night; On Tuesday she was towed up to the dockyard by Her Majesty's steamer Carron, and the same evening one of the directors of the British and American Navigation Company, for whose service she is built, arrived from London to superintend her refitment.—*Plymouth Journal.*

The Armed Steamer, Nemesis.—There is now lying in the Half-tide Basin of the Clarence Docks, Greenock, a very beautiful iron steamer, constructed by Mr. John Laird, of North Birkenhead, bearing the above name. She is fitted up with one engine of 120 horse power, and armed with two 32-pound carronades, the one fore and the other aft, which move on solid swivel carriages. Her draught of water is under four feet. Her crew will consist of 40 men. She will, it is said, clear out for Brazil, but her ultimate destination is conjectured to be to the Eastern and Chinese seas. On Monday last she made an excursion as far as the Floating Light, for the purpose of trying her machinery, which was found to work admirably.—*Edinburgh Observer.*

Leith Harbour and Docks.—Messrs. Walker and Cubitt have given in their report, and the Treasury have decided on adopting Mr. Walker's plan.

PROGRESS OF RAILWAYS.

Sheffield and Manchester Railway.—Mr. Vignoles has resigned his office as engineer-in-chief, and Mr. Locke has been appointed to succeed him. The directors, we understand, intend pushing forward with all possible vigour the works between Glossop and the Manchester terminus, so as to be able to open in the first instance through that very populous and productive district. The works at the summit tunnel are making very satisfactory progress.—*Railway Times.*

Hull and Selby Railway.—We understand that Mr. Walker, the company's chief engineer, has been in Hull this week, and after examining the various works on the line, has reported very favourably as to the progress which is being made in them; the bridges over the rivers Ouse and Derwent are in an advanced state of forwardness, and will both be completed in a few weeks; nearly the whole of the line is ballasted, and several miles of the permanent single way, on longitudinal bearers and cross sleepers, are already laid: large quantities of these are being constantly forwarded to the various portions of the line. The depôt and other buildings at Selby are in a very advanced state; this is also the case with those at the Hull terminus; and, although the past season has been a most unfavourable one for all railway works, it is still hoped that this undertaking will be ready to be opened for the whole length about Midsummer next. With respect to finances, we understand that the whole of the amount to be taken upon loan has been obtained without advertising, and the last call, notwithstanding the pressure upon the money market, has been remarkably well paid. We may congratulate our townsmen especially, and the inhabitants of the manufacturing districts of Yorkshire and Lancashire generally, on the prospect of speedily being enabled, by means of the Hull and Selby Railway, (connected as it is with the Leeds and Selby, the York and North Midland Counties, Manchester and Leeds, Manchester and Liverpool, Grand Junction, and London and Birmingham Railways,) to travel by this cheap, safe, and expeditious mode to all the principal towns in the kingdom. We are happy to learn that the price of shares in the Hull and Selby Railway is rapidly advancing in the market, and that before the opening of the line, as above stated, they are likely to be at par.—*Eastern Counties Herald.*

Edinburgh and Glasgow Railway.—We are glad to learn from a correspondent who lately visited the Edinburgh and Glasgow Railway works, now in progress, especially those through the Almond Valley, about eight miles from Edinburgh, under contract by Messrs. John Gibb and Son, on which there is one bridge of thirty-six arches, of fifty feet span each, besides numerous smaller bridges, extensive earth-cuttings, &c., that these gentlemen contemplate employing on these works, early in the spring, a vast number of masons, quarriers, earth-workers, and waggon-drivers. We have no doubt that this will be good news to many, especially as trade in the manufacturing districts is in such a depressed state.—*Aberdeen Journal.*

Dundee and Arbroath Railway.—This great public undertaking is nearly completed, the embankment has been formed up to the Gas Work, and in the course of two or three weeks the embankments from the east and west will have nearly met. As an arrangement has now, we believe been made with the Harbour Trustees, the public will soon have the full benefit of this conveyance from Trades-lane to Arbroath, and the inconvenience and trouble occasioned by the omnibuses will be avoided. It is said there will be a grand opening on the completion of the line; and it is not unlikely that Lord Panmure, who has all along manifested the greatest interest in the work, will be present. There are four vessels in a dangerous situation, as they will be closed in unless they get launched at the next stream tide; the parties will have themselves to blame if such an event takes place, the vessels being all ready for launching.—*Dundee Courier.*

Maryport and Carlisle Railway.—At a meeting of the directors of this railway, held on Saturday last, there was a report upon the state of the works, &c., by John Blackmore, Esq., lately appointed engineer to the company. It appears that about seven miles of the railway will be ready for the carriage of coal and lime about the first week in April next. Arrangements were entered into with parties desirous of taking coals along the line for shipment at Maryport, from which it is evident that an income will at once be realized sufficient to pay ten per cent. upon the amount of capital that will then have been expended, and this without taking into account any other source of traffic or the increase of coal that will undoubtedly take place. While upon this subject we beg leave to warn those shareholders, particularly the distant ones, who have not the opportunity of gaining correct information about the proceedings of the company, against a practice that has lately become too common of parties who calumniate and depreciate the value of property of the above description for the purpose of getting shares from the timid or neatly at very reduced prices. The engineer has commenced the necessary surveys for setting out the work on the remaining twenty miles, from Carlisle to Aspatria, and for enabling the agreements to be made for the land required. —*Carlisle Patriot*, January 11.

Great North of England Railway.—Two first-class railway carriages have just been placed on the line of the Great North of England Railway, at the Darlington Station. The carriages, which are from the manufactory of Mr. C. Burnup, of this town, are of the most splendid description, and combine every improvement that has hitherto been introduced. The interior arrangements are exceedingly comfortable, and the exterior decorations are beautifully executed, each door panel bearing the united arms of Newcastle, Durham and York, supported by the Northern Eagle. The carriages have since been inspected by several of the directors and engineers, who all express their entire satisfaction and admiration of their beauty and useful construction. It is expected that the portion of the line between Darlington and York, will be opened to the public in the course of the ensuing summer.—*Newcastle Journal.*

London and Birmingham Railway.—Saturday evening a considerable subsidence took place at the Blisworth embankment, half way between the station and the bridge over the canal. The earth having become thoroughly saturated by the late rains, gave way at the bottom, and the surface in consequence gradually sunk, at one point several feet. Since then it has continued to subside at the rate of about a foot an hour, and on one occasion between two and six in the morning, when the men ceased to work, it sank eight feet. A large force of men were collected the moment the slip was discovered, and employed day and night replacing the soil that had given way with ballast, the trains in the mean time passing slowly over the spot. The gap is always filled up by the arrival of a train, and the precautions taken are such as to do away with all idea of danger. The ballast is brought partly from Bugbrook, but chiefly from Hillmorton, about 16 miles distant.—*Northampton Mercury*, January 11.

Railway Speed.—Last week we referred to the facilities afforded by the Great Western Railway in the conveyance of newspaper expresses from Monmouth, and noticed the great rate of speed at which the special trains on these occasions had run. The *Dispatch* (Sunday paper), in alluding to one of its own expresses, states that the *Æolus* engine performed the first *ten* miles in *seven* minutes, and that if the engineer had not been compelled to slacken his speed in consequence of a train having started a short time previously, the whole distance of 31 miles could easily have been accomplished in 25 minutes. This is at the rate of 74 miles an hour!—*Railway Times*, Jan. 18.

London and South-Western Railway.—The whole of the rails being now laid down between the temporary terminus at Northam and the terminus on the Marsh, the engine has several times been along the whole line. The building on the Marsh is also completed, and rising, as it does, higher than any of the adjacent edifices, forms a very conspicuous object, especially when viewed from the water. Workmen are actively engaged on the yet unfinised part of the line between Winchester and Basingstoke, and though the late unseasonable weather has impeded their progress in a great degree, little doubt is entertained of their completing it by the 1st of May, when the good folks of Southampton will be enabled to reach the metropolis in three hours.—*Southampton paper.*

Morecombe Bay.—By the intended enclosure of Morecombe Bay and the Duddon Sands, 52,000 acres of land will be reclaimed, which will form two of the most beautiful valleys in the lake district of 83 square miles. The sands, being composed almost entirely of calcareous matter washed from the surrounding limestone, are capable of being formed into the most fertile soil for agriculture. The land proposed to be reclaimed, will form an area half the size of Rutlandshire, and, calculating one individual for two acres, will accommodate a population of 26,000, being about half the number of the present population of the counties of Huntingdon and Westmoreland, and, 5,000 more than that of Rutland. It would be about equal in population and extent to Lonsdale North, which is a peninsula lying between the two bays of Morecombe and the Duddon, on which stand the ancient ruins of Furness Abbey, and is also a rich agricultural and manufacturing district, abounding with slate, iron, and copper mines. By the reclaimed land being added to it, Lonsdale North would form one of the most pleasant and compact counties in the kingdom.—*Lancaster Guardian.*

Maidenhead Bridge on the Great Western Railway.—A correspondent informs us that during the hurricane of Friday, the 24th ult., the timber centerings of the bridge, which had been left standing under the arches for some time past as a precautionary measure, were completely carried away by the force of the wind and the timbers scattered about the river in all directions. This event will now decide whether the bridge will stand or not without the aid of the centres, it is very evident that the brickwork of the arches was not supported by the centres, as some have supposed, for if that had been the case, they could not have been so easily carried away.

NEW CHURCHES, &c.

Blackheath.—A new church intended for the accommodation of about 1100 persons is in progress of erection at Lee, near Blackheath. It is designed in the first pointed or early English style, adopting as a model for the component parts of the exterior, the Lady Chapel of Salisbury Cathedral. At the west end placed centrally rises a bold tower, which is surmounted by an octagonal belfry and spire, reaching to the height of 130 feet. The interior is divided into a nave and aisles by two ranges of clustered pillars, from which spring molded arches supporting the roof, the latter is of a triplex form the central division rising from nearly the same level as the sides, so that there is no clerestory. The ceiling is to be finished in a style posterior to that of the building generally, it will consist of plane surfaces divided into principal compartments by hammer beams or arched ribs, and these compartments subdivided into panels by smaller ribs, having boses at their intersections. A gallery is to be placed at the west end of the church, occupying lengthwise its entire width, and one bay or intercolumniation in depth. The whole area of the building has been excavated and a vaulted crypt formed, which is to be divided into numerous compartments, to be appropriated as family vaults. The external dressings throughout, together with the whole of the belfry and spire, as well as the pillars and arches of the interior are executed in stone.

Wolverhampton.—The erection of the new church in Horsley Fields will be commenced as soon as the necessary legal forms are completed. The building, as before stated, will be in the gothic style, and according to the design sent in by Mr, Harvey Eginton, of Worcester. Twenty-five plans were sent in, but several of them were unavoidably rejected on account of the cost of the proposed buildings exceeding the funds at the disposal of the committee. The structure will be eighty feet long and fifty-six feet wide, and is to be surmounted by a tower eighty-four feet high, in the style of the time of Henry VII. It will contain sittings for 1,200 persons, one-third of which are to be free.—*Wolverhampton Chronicle.*

Calcutta.—The Bishop of Calcutta has proposed building a cathedral church at Calcutta, in the Gothic style of architecture; unencumbered with galleries; with an ample chancel or choir; with north and south transepts or entrances; and capable of seating about 800 or 1,000 persons, its dimensions being probably somewhere about 180 or 200 feet, by 55 or 60; and 50 or 60 feet in height. In correspondence with this necessary magnitude of the body of the edifice, it is designed that the exterior of the building should bear some relation in its architectural character to the interior; and that an appropriate spire, somewhere about 200 feet in height from the ground, should be added, to give the whole a becoming and customary ecclesiastical aspect. It was, indeed, the unavoidable extent of a building which could at all meet the actual wants of the case in a climate like Bengal that first suggested the idea of erecting it in an open and beautiful spot, and of such a style of architecture as to form a prominent object from every point of view on the esplanade, within the fine panorama of Calcutta, and thus constitute the greatest ornament of what has not been unfitly termed the City of Palaces. And it was thought there are few who would not willingly make an additional effort—if we once determine to build a new and large church—to give it all the advantages which the progress made of late years in sacred architecture can secure, so as to render it fitting to be the first Protestant cathedral erected to the honour of God in India.

Liverpool.—The first stone of a new church, to be called after St. Barnabas, to be erected on a plot of land between Parliament-street and Greenland-street, a few yards from the Queen's Dock, was laid on Tuesday, December 17. St. Barnabas' church will be a handsome structure, in the early English or Lancet style, and a decided ornament to that part of the town. The principal elevation will be towards Parliament-street, and from the centre there will rise a beautiful tower and spire to the height of 135 feet. The former will be finished with a pierced battlement on four sides and shafts with pinnacles at the angles. The whole will be faced with red stone in large courses. The interior will correspond with the general style. It will have a nave separated from the aisles by moulded stone piers and arches, supporting a clear story in which there will be windows of three lights. The ceiling is to be ribbed and pannelled, and the ribs will be painted to resemble oak. It is intended to furnish 1200 sittings; on the ground floor there will be 471 sittings and 236 free sittings, in the gallery 346 sittings and 147 free, making 1200, of which 383 will be dedicated to the use of the poor for ever. The cost will be upwards of £4800. The architects are Messrs. Arthur and George Williams, of No. 2, Tarleton-street, and Mr. William Morrison, of Toxteth-park, is the contractor.—*Liverpool Standard.*

The new church at Boughton, in this county, which has been built upon a wet loose soil, has been some time subsiding, but the late rains have so impaired the foundation that the tower at the western extremity first sunk, and then fell to the ground, and the other appears also to be sinking very fast. Of course the whole presents a very ruinous appearance.—*Kent Herald.*

GEOLOGY.

Geology in Devon.—Dr. Buckland and Mr. Conybeare have both hastened to visit the late landslip on the coast of Devon, which, we understand, offers some very curious phenomena to the geologist both inland and out at sea, where, at a considerable distance from the shore, a new solid ridge has been thrown up by this convulsion of nature.—*Naval and Military Gazette.*

The Lagoons.—A Vienna correspondent of a Paris paper states that accounts had been received from Venice of the disappearance of a little island of the Lagoons in the waves of the Adriatic, 12 persons who were on it having been buried in the waters when the island was overwhelmed. The Archduke, Viceroy of the kingdom of Venetian Lombardy, had gone from Venice to Padua to inspect the ravages caused by the late inundations, and the clergy of Milan and Cremona were exerting themselves to relieve the sufferers.

Earthquake at San Salvador.—We have been favoured with the following extract of a letter from San Salvador, dated the 5th of October, 1839:—"On the 1st instant, at 2 a.m., we experienced a strong shock of an earthquake, and at 3 a.m., an hour after, a concussion which has nearly destroyed the town. The shocks continue, and yesterday we had 15 tolerably smart shocks. Many people have left the place, and I fancy the Government will remove to Cojntopeque, as this town is not safe. The evil is under our feet; for at places five or six miles off nothing has occurred. The houses are nearly unroofed, and the walls are so tottering that we all sleep in the court-yard or the great square, under hide coverings, which is pleasant enough in the rainy season, and sit in the day time in the corridors ready for a start into the yard, as it will not do to wait a moment when the shock comes."

LIST OF NEW PATENTS.

Granted in England from 1st to 28th January, 1840.

John Leo Nicolas, of the parish of Clifton, Bristol, Gentleman, for "*certain improvements in the method of constructing and propelling carriages on railways or common roads, and through fields for agricultural purposes.*"—Sealed, January 1; six months to specify.

Samuel Lawson, of Leeds, and John Lawson, of the same place, Engineers, and Co-partners, for "*improvements in machinery for spinning, doubling, and twisting flax, wool, silk, cotton, and other fibrous substances.*" Communicated by a foreigner residing abroad.—January 2; six months.

Charles Greenway, of Douglas, in the Isle of Man, Esq., for "*certain improvements in reducing friction in wheels of carriages, which improvements are also applicable to bearings and journals of machinery.*"—January 3; six months.

John Francois Victor Fabien, of King William Street, in the city of London, Gentleman, for "*improvements in pumps.*"—January 7; six months.

David Low, of Adam's Court, Old Broad Street, Merchant, for "*improvements in machinery for crushing, preparing, and combing flax, hemp, phormium tenax, and other fibrous substances.*" Communicated by a foreigner residing abroad.—January 7; six months.

Moses Poole, of Lincoln's Inn, Gentleman, for "*improvements in obtaining power.*" Communicated by a foreigner residing abroad.—January 7; six months.

John Ridgway, of Cauldon Place, Stafford, China Manufacturer, for "*an improvement in the moulds used in the manufacture of earthenware, porcelain, and other similar substances, whereby such moulds are rendered more durable.*"—January 11; six months.

John Ridgway, of Cauldon Place, Stafford, China Manufacturer, and George Wall, the younger, of the same place, Gentleman, for "*certain improvements in the manufacture of china and earthenware, and in the apparatus or machinery applicable thereto.*—January 11; six months.

John Ridgway, of Cauldon Place, Stafford, China Manufacturer, and George Wall, the younger, of the same place, Gentleman, for "*certain improvements in the mode of preparing bats of earthenware and porcelain clays, and forming or shaping them into articles of earthenware and porcelain, and in the machinery or apparatus applicable thereto.*"—January 11; six months.

Robert Montgomery, of Johnstone, in the county of Renfrew, Gentleman, for "*an improvement or improvements in spinning machinery, applicable to mules, jennies, slubbers, and other similar mechanism.*"—January 11; six months.

Christopher Edward Dampier, of Ware, Attorney-at-law, for "*an improved weighing machine.*"—January 14; four months.

Hezekiah Marshall, of the city of Canterbury, Architect, for "*improvements in window sashes and frames, and in the fastening of window sashes.*"—January 14; six months.

Arthur Eldred Walker, of Melton Street, Euston Square, Engineer, for "*improvements in engraving by machinery.*"—January 14; six months.

Charles Wheatstone, of Conduit Street, Hanover Square, Esq., and William Fothergill Cooke, of Sussex Cottage, Slough, Esq., for "*improvements in giving signals and sounding alarms at distant places, by means of electric currents.*—January 21; six months.

Samuel Brown, of Finsbury Pavement, Civil Engineer, for "*improvements in making casks and vessels, of or from iron, and other metals.*—January 21; six months.

Joseph Rock Cooper, of Birmingham, Gun Maker, for "*improvements in fire-arms, and in the balls to be used therewith.*—January 21; six months.

William Stone, of Winsley, Gentleman, for "*improvements in the manufacture of wine.*"—January 21; six months.

James Hall, of Glasgow, Upholsterer, for "*improvements in beds, mattrasses, and apparatus applicable to bedsteads, couches, and chairs.*—January 21; six months.

Arthur Howe Holdsworth, of Brookhill, Devon, Esquire, for "*improvements in preserving wood from decay.*"—January 21; six months.

William Coltman, of Leicester, Frame Smith, and Joseph Wale, of the same place, Frame Smith, for "*improvements in machinery employed in making frame-work, knitting, or stocking fabrics.*"—January 21; six months.

Samuel Wilkes, of Darlston, Iron Founder, for "*improvements in the manufacture of hinges.*"—January 21; six months.

George Wilson, of Saint Martin's Court, Saint Martin's Lane, for "*an improved paper-cutting machine.*"—January 21; six months.

Charles Rowley, of Birmingham, Stamper and Piercer, and Benjamin Wakefield, of Bordesley, Machinist, for "*improved methods of cutting out, stamping, or forming, and piercing buttons, shells, and backs for buttons, washers, or other articles, from metal plate, with improved machinery and tools for those purposes.*—January 21; six months.

Edward Halliley, of Leeds, Cloth Manufacturer, for "*improvements in machinery for raising pile on woollen and other fabrics.*—January 21; six months.

William Hunt, of the Portugal Hotel, Fleet Street, London, Manufacturing Chemist, for "*improvements in the manufacture of potash and soda, and their carbonates.*"—January 21; six months.

Miles Berry, of Chancery Lane, Patent Agent, for "*certain improvements in the manufacture of prussiate of potash and prussiate of soda.*" Communicated by a foreigner residing abroad.—January 21; six months.

Jules Alphonse Simon de Gournay, of Bread Street, London, Gentleman, for "*improvements in the manufacture of horse-shoes.*" Communicated by a foreigner residing abroad.—January 21; six months.

George Clarke, of Manchester, Manufacturer, for "*certain improvements in the construction of looms for weaving.*"—January 21; six months.

Alexander Helt, of Gower Street, Bedford Square, Surgeon, for "*certain improvements in the arrangement and constructian of fire-grates, or fire-places, applicable to various purposes.*"—January 23; six months.

James Bingham, of Sheffield, Manufacturer, and John Amory Boden, of the same place, Manufacturer, for "*certain improved compositions, which are made to resemble ivory, bone, horn, mother-o'-pearl, and other substances, applicable to the manufacture of handles of knives, forks, and razors, piano-forte keys, snuff-boxes, and various other articles.*"—January 25; six months.

James Smith, Junior, and Francis Smith, of Spital Works, near Chesterfield, Lace Manufacturers, for "*certain improvements in machinery for the manufacture of figured bobbin-net, or lace.*—January 28; six months.

Thomas Aitken, of Chadderton, Manufacturer, for "*certain improvements in the machinery or apparatus for drawing cotton and other fibrous substances.*"—January 28; six months.

William Pontifex, of Shoe Lane, in the city of London, Coppersmith, for "*an improvement in treating fluids containing colouring matter to obtain the colouring matter therefrom.*"—January 28; six months.

Henry Curzon, of the borough of Kidderminster, Machinist, for "*certain improvements in steam-engines.*"—January 28; six months.

John Whitehouse, of West Bromwich, in the county of Stafford, Iron Master, for "*improvements in preparing and rolling iron, and other metals, or metallic alloys, for the manufacture of certain articles of commerce.*"—January 28; six months.

William Mottershaw Forman, of Sheepshead, in the county of Leicester, Frame Smith, for "*certain improvements in stocking frames, and machinery used in frame-work knitting.*"—January 28; six months.

TO CORRESPONDENTS.

In consequence of the great advantages to correspondence by the universal introduction of the penny post throughout the United Kingdom, we hope that our readers will do us the favour to forward accounts of all new buildings, public works, new inventions and discoveries, reports of scientific meetings, new engines, steam boats, docks, canals, harbours, &c., if a tithe of our readers will only take the trouble to forward a dozen lines monthly, it will be the means of affording such a mass of information, that could not fail to be most valuable to the profession.

We thank our correspondent at Montreal for his letter, we think that he and his professional brethren might obtain the Journal in a far more direct manner, than through the circuitous and expensive channel of New York. We advise him to consult a respectable bookseller, or some agent who is in constant correspondence with England. We shall be happy to receive the information he proposes.

We feel particularly obliged to our correspondent Mr. W. R. Casey *of New York, for his valuable contributions, we hope to have a continuation of them.*

A correspondent requests us to publish the description of the Epicycloidal motion for a steam engine which we stated was not new. We will, if we can find room, do so next month, ro refer him to works and places where it may be seen. The last time we visited the Arsenal at Woolwich, we saw the motion applied to the working of a perpendicular saw for cutting timber.

R. W. T.'*s last letter we will answer next month. His former communication was received, we did not insert it as we were desirous of avoiding the insertion of any further articles on railway curves.*

Diogenes' *apparatus for stopping carriages on railways will appear next month, will* Diogenes *be so good as to inform us if it be the same apparatus as Thompson's alluded to in his paper in last month's Journal.*

I. Z.'s *drawing for a paddle wheel with reefing paddles, constructed by Boulton and Watt, in* 1815, *will appear next month.*

H. B.'s *syphon for a high pressure steam gauge we will notice if we can spare the room next month.*

We have this month made an alteration in the Journal by the introduction of engravings instead of wood cuts; this plan we shall occasionally adopt when the subjects for illustration are of a minute character. At the end of the year, when the numbers are bound up, the plates will be placed opposite to the letterpress referring to them.

Communications are requested to be addressed to "The Editor of the Civil Engineer and Architect's Journal," *No.* 11, *Parliament Street, Westminster, or to Mr. Groombridge, Panyer Alley, Paternoster Row; if by post, to be directed to the former place; if by parcel, to be directed to the nearest of the two places where the coach arrives at in London, as we are frequently put to the expence of one or two shillings for the* porterage only, *of a very small parcel.*

Books for review must be sent early in the month, communications on or before the 20th (if with wood-cuts, earlier), and advertisements on or before the 25th instant.

The First Volume may be had, bound in cloth and lettered in gold, Price 17s.

⁂ The Second Volume may also be had, Price 20s.

Improved Steam Engine with two Cylinders.

Fig. 1.

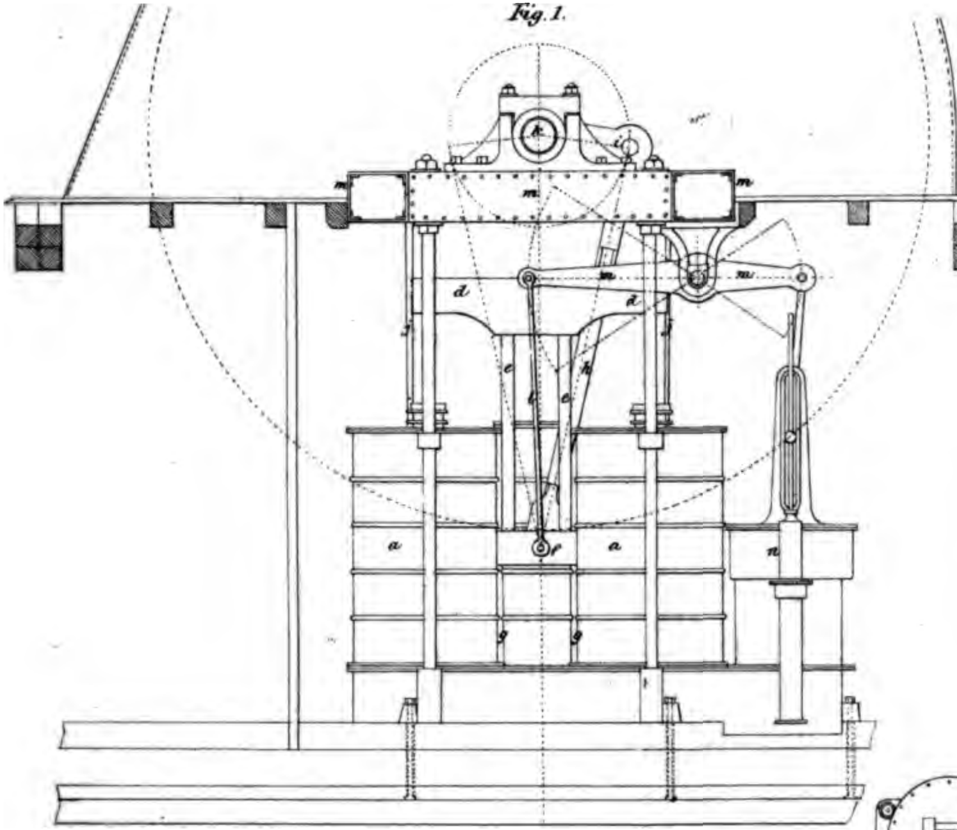


Fig. 2.

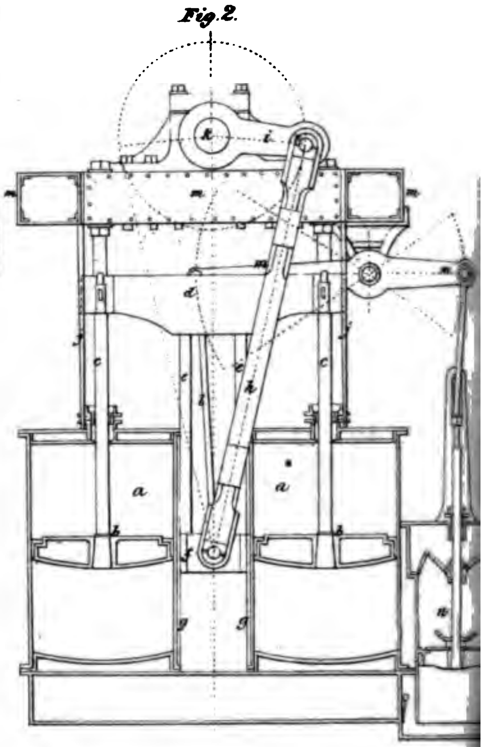


Fig. 9.

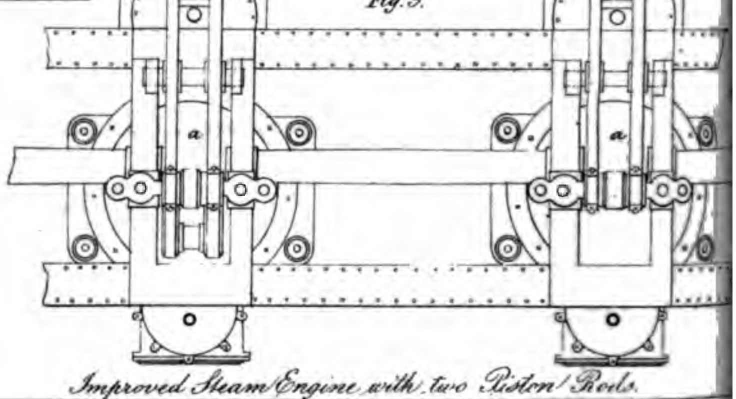


Fig. 3.

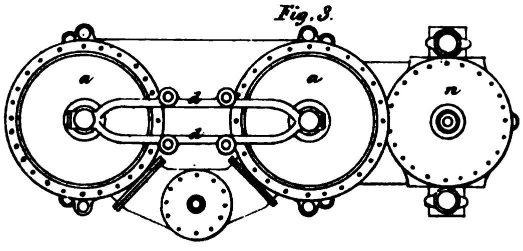
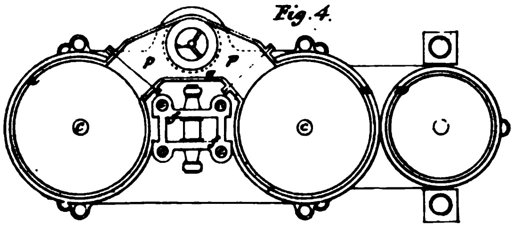


Fig. 4.



Improved Steam Engine with two Piston Rods.

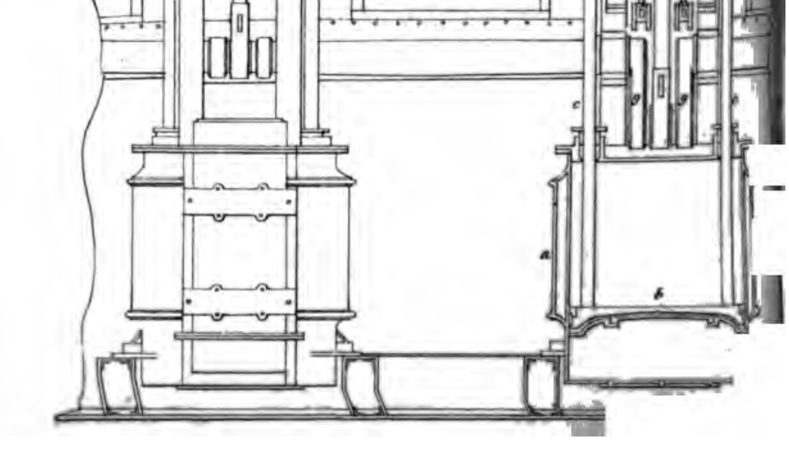


Fig. 7. Fig. 8.

Improved Steam Engine with two Cylinders.

Fig. 5.

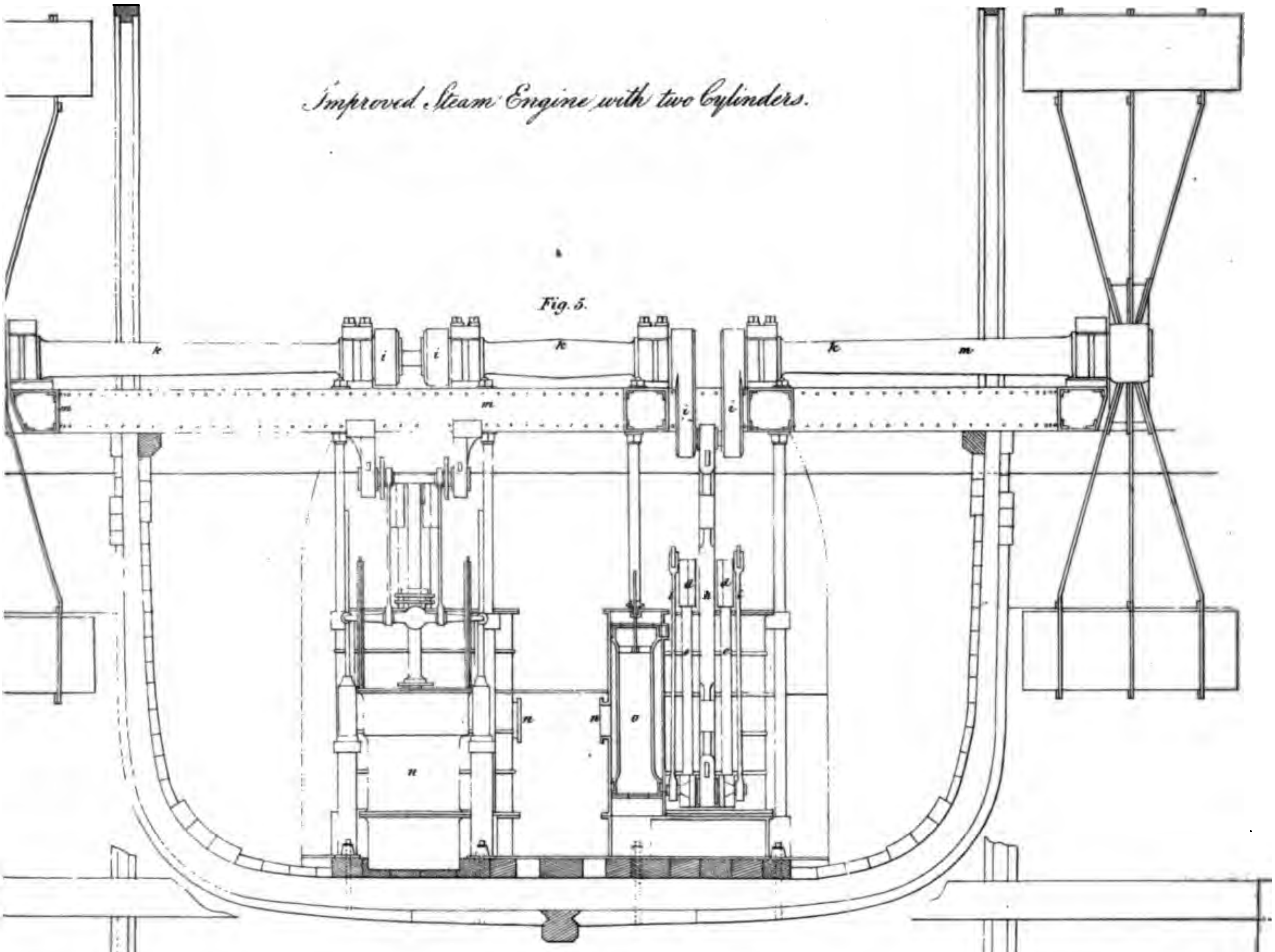
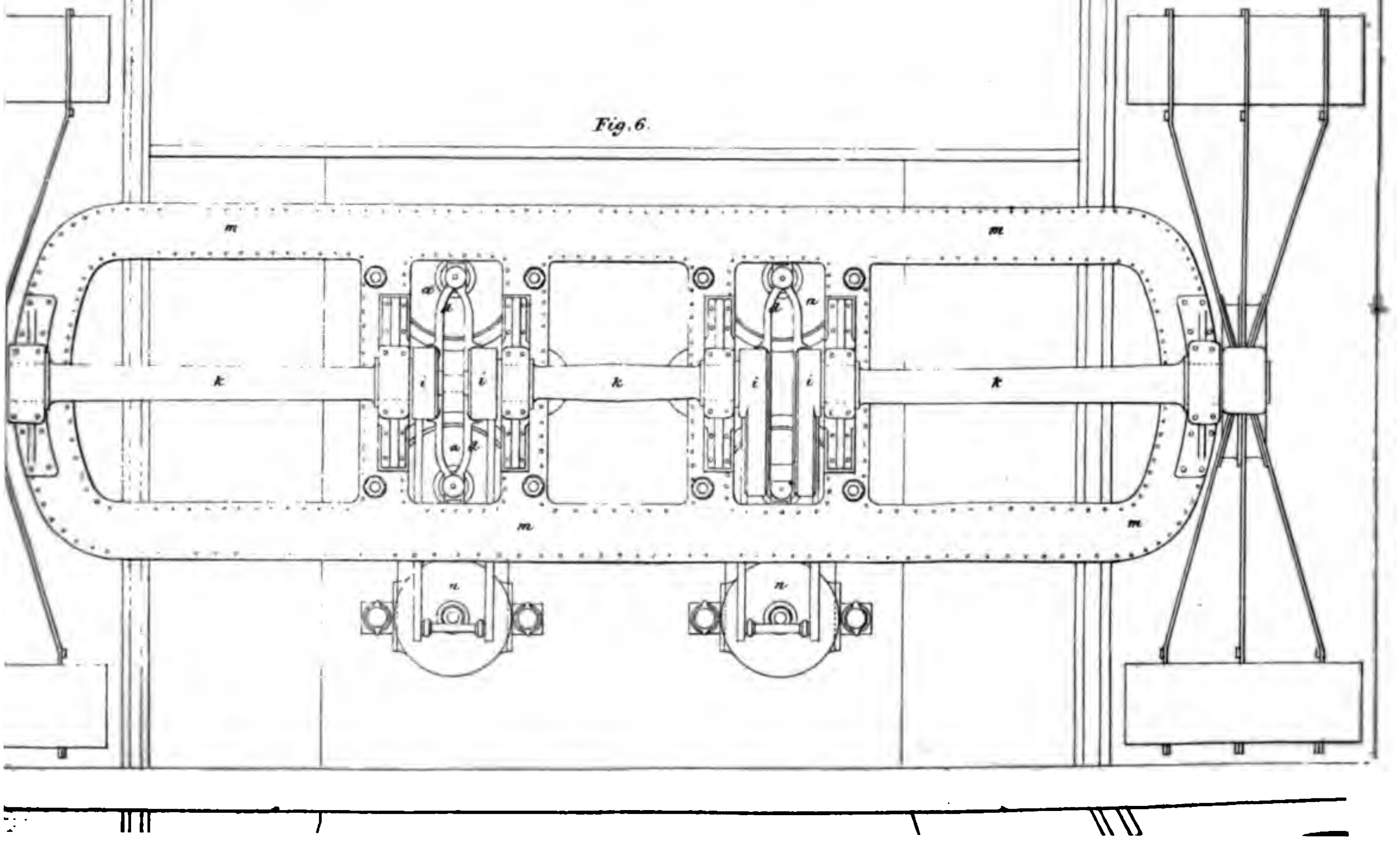


Fig. 6.



IMPROVEMENTS IN THE CONSTRUCTION OF MARINE STEAM ENGINES.

WHICH ARE PARTICULARLY APPLICABLE TO STEAM ENGINES OF THE LARGEST CLASS.

With two Engravings, Plates V and VI.

SPECIFICATION *of a Patent granted 7th May*, 1839, *to* JOSEPH MAUDSLEY *and* JOSHUA FIELD, *of the firm of Maudsley, Sons and Field, Engineers of Lambeth.*

THESE improvements in the construction of marine steam engines are particularly applicable to those of the larger class, and are designed principally for the purpose of producing and applying a greater amount of steam power, than has heretofore been available within a given space or area on shipboard. This is effected by different constructions, arrangements, and proportions, of the parts of low pressure engines, allowing a more perfect application of the expansive force of steam without increasing the weight of the whole machinery.

The first feature of these improvements consists in adapting two steam cylinders to one engine, in such a way that the steam shall act simultaneously upon both pistons, in order that they may be made to rise or fall together, the piston-rod of each being attached to one horizontal cross-head, and thereby the combined action of both pistons applied to one crank of the paddle-shaft.

The second feature of these improvements applies more particularly to engines for river navigation, and consists in the adaptation of a piston with two rods, working in a steam cylinder of large area, both piston-rods being connected to one cross-head above, which gives motion to the crank below it, by a single connecting rod.

The third feature of these improvements consists of a method of adjusting the expansion valves of combined engines, by which the period for shutting off the steam at any part of the stroke may be regulated in both engines at once by a single movement, whilst the engines are working.

The fourth feature of these improvements is the peculiar construction of the main beams of the framing that carry the plummer blocks of the main crank shaft, to which the paddle-wheels are attached. These beams are formed as hollow trunks, by the combination of wrought iron plates attached to bars of angle iron, in the same way as ordinary boilers are made, and we are enabled by that means to construct beams of the largest dimensions of unlimited strength and of comparatively small weight.

These improvements will be more fully understood by reference to the accompanying engravings and the following description thereof, in which Fig. 1 is an elevation taken longitudinally, representing an engine with two cylinders, constructed upon the plan described as the first feature of the improvement. Fig. 2 is a vertical section of the same, taken through the cylinders. Fig. 3 is a horizontal section of a vessel, in which the situation of the engine shown at Fig. 1 is seen as it would appear when looking upon it from above; and Fig. 4 is a corresponding engine placed at the other side of the vessel, but represented in section cut horizontally through the cylinders. Fig. 5 is a vertical section taken transversely through a steam vessel, showing the positions of two engines, as in Figs. 3 and 4, the one engine being in section, the other an external view seen upon a plane in advance of the former. And Fig. 6 is a plan or horizontal view of a portion of the steam-vessel, with the engines and their appendages, and also the framing by which the crank-shafts of the paddle-wheels are supported, similar letters referring to the same parts of the machinery in all the preceding figures.

The two connected working cylinders are shewn at *a a*, their pistons at *b b*, and the piston rods at *c c*, the upper ends of which rods are affixed by keys to the cross-head *d*. Four vertical rods *e e e e*, affixed at top to the cross-head *d*, are connected at bottom to a slider *f*, which slider is enabled to move up and down on the guide-ribs *g g*, formed on the outer surfaces of the cylinders. To this slider *f* one end of a connecting rod *h* is attached, the other end of that rod being attached to the crank *i* of the propelling shaft.

From this arrangement it will be perceived that, by the simultaneous ascent and descent of the two pistons *b b* in their working cylinder *a a*, the rods *c c* will cause the cross-head *d* to move perpendicularly np and down between its guide bars *j j*, and in so doing to raise and depress the slide *f*, with the connecting rod *h*, which rod will, by that means, be made to give rotary motion to the crank *i*, and thereby cause the paddle-wheel shaft *k* to revolve. A rod *l*, connected to the slide *f*, will at the same time work the lever *m*, to which the rod of the air-pump *n* is attached.

The mode of adapting the steam-valve of the combined cylinders *a a*, is best seen in Figs. 3 and 4. The steam is admitted to, and withdrawn from, these cylinders, by one slide valve common to both, through a pipe *n*, seen in Fig. 5. From this pipe *n* the steam proceeds, through a slide valve *o* of the ordinary construction, and through the curved passages or tubes *p p* into both cylinders. There is also a narrow passage of communication always open at *q*, by which the steam is allowed to pass from one cylinder to the other for the purpose of keeping the pressure equal at all times in both cylinders.

The expansion valve is on the steam-pipe *n*, at the entrance to the slide valve. The slide is moved by an eccentric in the ordinary way; and the expansion valve is regulated by the means described hereafter under the third feature of the invention.

The advantages proposed by this arrangement are, simplicity of construction, more direct action on the crank, saving of space and weight of material, offering every means of giving larger area of cylinder, whereby a given amount of steam can be used more expansively than in former arrangements, and consequently yield more power and economize fuel, with the further advantage at sea, that when the engine is reduced in the number of its strokes by deep lading with coal, as at the commencement of a voyage, or by head winds, more steam may then be given to the cylinders, and, under such circumstances, more speed to the vessel, all the steam generated in the boiler being usefully applied.

The second feature of this invention, viz. the improved construction of steam engine having two piston rods working in one cylinder, is represented in the accompanying engravings at Figs. 7, 8, and 9. Fig. 7 is an elevation of the engine. Fig. 8, a section of the same, taken vertically through the cylinder, with the crank and shaft of the paddle-wheels; and Fig. 9 is a horizontal view, as seen from above, of the two engines and their appendages, the same letters of reference pointing out similar parts of the machinery in all the three last mentioned figures.

The cylinders of large area are shown at *a a*, and *b* are their pistons; *c c* are two perpendicular rods inserted into each piston, and working through stuffing boxes in the lid of the cylinder; *d* is a cross-head, to which the two piston-rods are keyed at top, and *e e* are the guide-rods, fixed on cast iron supports, upon which rods the cross-head *d* slides up and down. The connecting rod *f* is attached above to the cross-head, and below to the crank *g g* on the paddle shaft. The other parts of the engines will appear so obvious from inspecting the drawings, as not to require any further description.

It will be perceived that by this arrangement of the parts of the engine, motion is given to the crank-shaft below the cross-head, by a single connecting rod.

The advantages resulting from this improvement are, that a paddle-shaft, placed at a given height from the bottom of the vessel, will be enabled to receive a longer stroke of the piston than by any other arrangements now in use, a more compact and firm connection of the cylinder with the crank-shaft bearings is effected, and a cylinder of much greater diameter may be applied, by which the principle of working steam expansively may be more fully carried out, and a more direct action of the steam power on the crank obtained, with a less weight of materials and a greater economy of space than has heretofore been attained, by any of the arrangements of marine engines in use.

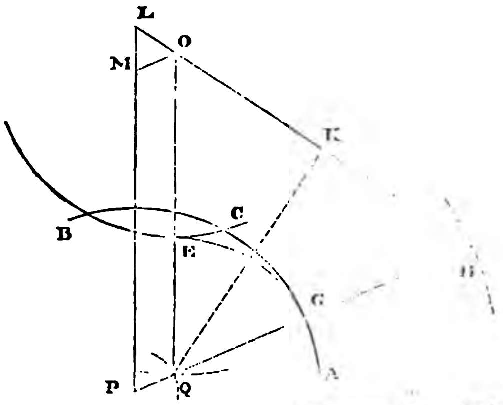
The third feature of the invention, viz. the method of adjusting the expansive valves of combined engines, regulates the flow of the steam into both engines at once, by one simple movement of the spindle and pinion, and without interrupting for a moment the working of the engines, such a means of adjustment being highly important in bringing into operation the full effect of steam applied upon the expansive principle, in economizing fuel, and adapting the power of engines to the varying circumstances at sea, between light and heavy lading, and between strong head-wind and scudding before the gale.

EXTENSIVE USE OF SLATE.—Slates are now applied to purposes unthought of till lately; and when deposited in drains, as the bottoms of tiles, are found as efficacious in keeping the land, as houses, dry. Compared to dressed free-stone, or flat tile, they are at once lighter and less expensive; ease in handling is a great advantage, and equally, or more so, the alleged property of "lasting for ever." Mr. Lawrie, Terregles-town, was foremost in trying the experiment in Dumfriesshire, and his expectations have been so fully realized that his example will be very generally followed wherever drains remain to be cut, and that is sectionally, at least almost everywhere. Of the article in question he has imported from Bangor 200,000 bottoms or pieces, and may have occasion to commission further cargoes. The first imported measured six inches by five: but as these were found a kennan too small, the size has been increased an inch each way—that is seven by six. The price put on board is 7*s*. per thousand, and, as wares every way so equable pack as beautifully as herrings in a barrel, we presume, although we do not know the fact, that freightage from Wales will not greatly exceed 1*s*. additional.—*Glasgow Courier.*

RAILWAY CURVES.

On reconsidering this subject, we think, as our correspondent R. W. T. suggests, that the engineer who has to set out the line of a railway upon the ground should, in general, confine himself to the *curves*, and in every respect to the line laid down upon the plan, in which case no such question as that proposed by "An Assistant Engineer," could occur. But, since a deviation from the plan may in some instances be allowed, as "An Assistant Engineer's" question proves, we shall endeavour to solve R. W. T.'s difficulty; and for this we must first consider what may have been the cause of the failure. Now there are two cases: *either* the curve has been commenced at a wrong point of the tangent, *or* the operation of setting it out has been inaccurately performed. In the first case the error can be rectified by referring to the plan and ascertaining the right point of contact, and then setting out the curve afresh. This method would, no doubt, be exceedingly troublesome, and it appears to be the object of "An Assistant Engineer" to dispense with the labour attending such a proceeding; the question then is, what is the best method of getting over the difficulty without returning to the plan laid down, when a deviation from the latter is allowable. Now when two curves were intended to meet and form an S, and the engineer employed to set them out has not succeeded in effecting their junction, there are two cases: *either* the two curves intersect each other, *or* they do not. In the first of these cases, it is true, the two curves *may* be joined by a third, tangent to the two former, and of less radius than the one which it touches on the concave side, though, in our opinion, it would be preferable to correct the curve in accordance with the plan. Now there are an infinity of circular arcs which will satisfy the condition of being tangent to the two given curves, so that another condition must be imposed before the connecting curve can be determined; it may therefore be required, either that this curve shall touch the concave or the convex curve at a given point, or that its radius should be of a given length, which latter is the condition assumed by "An Assistant Engineer." We should recommend solving the problem on the plan, and not on the ground, believing the former mode to be much more facile than the latter; we shall therefore adapt our solution to that method.

Fig. 1.



Let A B and C D, (fig. 1) be the two given curves (say of 130 chains radius), and let it be required to unite them by a third curve of less radius, tangent to A B on its concave, and to C D on its convex side.

1st case. The required curve is to pass through the point G of the curve A B.

From P, the centre of A B, and through G, the required point of contact, draw the straight line P G H, equal to the sum of the radii of the two given curves, or twice the radius P G (both curves being supposed to have the same radius); from H draw the straight line H O to the centre of the curve C D; and from K, the middle point of H O, draw the perpendicular K Q, intersecting the straight line P H at the point Q. Q will be the centre of the required curve, and its radius will be equal to Q G. Join Q O, and the point E, where Q O intersects the curve C D, will be its point of contact with the required curve.

For, the right angled triangles H K Q, Q K O being equal, Q H = Q O; and, if from these equals we take the equals G H and E O, the remainders Q G, Q E will also be equal; and, since they are situated on normals to the given curves, the circular arc G E will be tangent to both these curves.

2nd case. The required curve must pass through the point E in the curve C D.

From the centre O, and through the given point of contact E, draw the straight line O E Q; and from the centre P draw P L parallel to O Q and equal to the sum of the radii of the given curves; from P as a centre, and with a radius equal to P L, describe an arc of a circle in the direction in which the connecting curve G E is expected to meet the given curve A B, and from L draw the straight line L O H, intersecting that arc at the point H; join H P. The point Q, where H P intersects O Q, will be the centre of the required curve, and the point G, where it intersects the curve A B, will be the point of contact of the required curve with A B.

For, since O Q is parallel to L P, the triangles O H Q, L H P are similar; and consequently, L P being equal to P H, O Q = Q H; and, if from these equals we take the equals E O, G H, the remainders Q G, Q E will also be equal. And an arc of a circle passing through the points G and E, and having Q for its centre, will be tangent to the two given curves, as we proved for the first case. Or after having drawn O Q and L P, construct the isosceles triangle O L M, of which the side O M = M L; then from P as a centre, and with a radius = M L, describe an arc of a circle, intersecting O Q at the point Q, which will be the centre of the required curve, as before.

For, if through the point Q we draw the straight line P H equal to P L, we shall have, by reason of the similar triangles H Q O, H P L, Q H = Q O; and, taking away the equals G H, E O, we have Q G = Q E, as before.

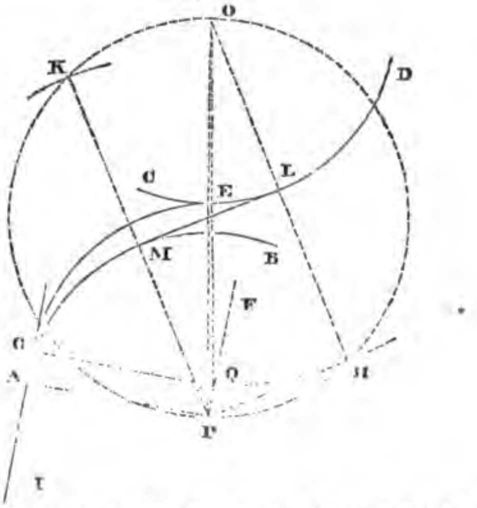
3rd case. The required curve is to have a given radius (say 100 chains).

From the point O as a centre, and with a radius equal to the sum of the radii of the given curve C D and of the required connecting curve, describe an arc of a circle in the direction in which the centre of the latter is expected to be found, and from the centre P, with a radius equal to the difference between the radius of the curve A B and that of the required curve, describe another arc, intersecting the former Q. Q will be the centre of the required curve.

For, drawing the radius P G through the point Q, the part Q G is equal to the radius of the connecting curve, since P Q is the difference between that radius and P G; also Q E is equal to the radius of the required curve, because O Q is equal to that radius, plus the radius of the curve C D, which is equal to the part O E, therefore the remaining part Q E is equal to the radius of the required curve. And it may be proved, as in the former cases, that the arc G E, described with that radius and with the centre Q, will be tangent to both the given curves.

In the case when the two curves intended to have met do not intersect each other, we should certainly recommend connecting them by a tangent, if it should not be required to make them meet, as in the plan.

Fig. 2.



Let A B, C D (fig. 2) be the given curves, the former being tangent to the straight line I A at the point A. To draw a common tangent to the two given curves.

Join (on the plan) their centres O and P by a straight line, and on O P as a diameter, describe the circumference O H P K; than from O and P as centres, and with radii equal to the sum of the radii of the two given curves, describe two arcs of circles intersecting the circumference O H P K in the points H and K respectively; draw the radii O H and P K, and the points L and M, where they intersect the given curves, will be their points of contact with the tangent, that is to say, a straight line L M, drawn through these points, will be tangent to both the given curves.

For O H and P K are parallel, and L H = P M; therefore, joining P H, L M and P H are equal and parallel; but P H is perpendicular to O H, therefore L M is perpendicular to the radius O L, and consequently tangent to the arc C D. In the same manner it may be proved to be tangent to A B. Therefore L M is the common tangent required.

If, on the other hand, it be required to move the curve A B along the tangent I A, from which it springs, until it comes in contact with the curve C D.

From the centre P draw P F parallel to I A, which produce in the direction A G; and from O as a centre, and with a radius equal to the sum of the radii of the given curves, describe an arc of a circle intersecting P F and Q. The point Q will be the centre of the curve which will touch the curve C D and the straight line T G; and, if we draw O Q and Q G, the latter perpendicular to A G, the points E and G, where these two lines cut the curve C D and the straight line A G, respectively, will be the points of contact, and the arc E G will be the required curve.

For Q G and Q E are each equal to the radius P A, and the former is perpendicular to A G, and the latter to the tangent to the curve C D at the point E. Therefore E G is the position of the required curve.

We have thus far only considered the case where the failure has resulted from making one of the curves spring from the wrong point of the tangent. In the other case, that is, when the operation of setting out one or both of the curves has been inaccurately performed, there is no remedy but to set it out again with more care.

CANDIDUS'S NOTE-BOOK.

FASCICULUS XIII.

> "I must have liberty
> Withal, as large a charter as the winds,
> To blow on whom I please."

I. Let B. of Derby be whoever he may, his remarks on Competition Designs are very much to the purpose; and he not only hits the right nail on the head, but gives it a clincher, when he hints very broadly that the profession have to thank themselves for the abuses which now prevail with respect to competition. If instead of merely shrugging their shoulders with a most Turk-like resignation, they were to apply them heartily to the wheel, they might extricate themselves from a position they affect to deplore. Surely if the Institute were to set about doing so in downright earnest, they might both devise and enforce a greatly better system of competition than the hollow, shuffling, delusive one now practised. Undoubtedly there are many difficulties to contend with,—first and foremost, their own apathy, indifference and want of unanimity of purpose. Some among them are notoriously opposed to competition altogether, and perhaps that the bungling and blundering now so rife in it, will sooner or later cause it to be abandoned entirely. Others seem to be afraid of making any stir about what does not immediately concern them as individuals. On that very account all the more imperative is it that the Institute as a body ought to consult the interests of the profession generally. And if competition be not a case wherein it ought to interfere with all its authority,—be not more especially one which calls for hearty co-operation, I should very much like to know where co-operation can at any time be of positive service. Were the Institute a private Club, it might be left to do as it pleased: but it is—and it may be presumed, wishes to be considered in a very different light,—to cut a figure in the eyes of the public.

II. Whether any one will agree with me or not, I incline to the opinion that so far from being at all calculated to improve architectural taste, such a work as Nash's Mansions is likely to flatter a very corrupt one, and to create a prejudice in favour of a style that taken apart from the associations and accidents, is characterized by fantastic dullness, by incoherent caprices, by expensive ugliness, and by a grotesque combination of extravagant embellishment and offensive meanness. What then, am I insensible to the charm which the mastery of the artist's pencil has communicated to the series of architectural subjects above-named? Certainly not, because it is precisely on account of the fascination with which he has invested them, that I hold them to be dangerous, and apt to seduce, and mislead those who have not the power of discriminating between the architectural deformity of many of the scenes, and the pictorial attractiveness with which they are represented. Undoubtedly many of them are highly picturesque in themselves, and rendered still more so by the manner in which they are treated, and by the adventitious interest arising from costume and figures. Still as architecture, they are for the most part naught,—absolutely frightful. Were equal witchery of effect put into it, not the homeliest merely, but nearly the most insipid subject of the kind might be rendered captivating,—an old barn, a village carpenter's shop, or the kitchen of a country inn. The chief difference would be that in such case persons would not be similarly imposed upon, but instead of attributing any beauty to the scene itself, or being at all blinded to its uncouthness, would perceive that the pleasure it affords arises entirely from the charms with which the pencil has arrayed it.

III. I should very much like to know if, among the numerous churches which have been erected of late years, there be a single one whose interior possesses, or even approximates in any degree to solemnity of character, which quality, it may be presumed, is perfectly appropriate and becoming, or, in fact, to be considered indispensable, to a place of worship. Among all the new churches I have seen, I have certainly not beheld one possessing internally any thing like solemnity in its general effect; on the contrary, differ how much they may as to all other circumstances, they agree as far as the absence of that quality goes. Some are dismal and mean enough, others, if not particularly tasteful, smart enough, just the very places for a fashionable congregation, whom the architect generally takes care to arrange so that they shall make as goodly a show as the audience of a theatre, and be able to reconnoitre each other without obstruction. In fact, there is, so far, very much more of the play-house than of the house of prayer in such buildings—nothing calculated to inspire feelings of reverence. Neither does it make much difference what style be employed, since the interiors of our modern Gothic churches have no greater air of impressive solemnity than have those in any other style. In only very few instances is there any attempt to keep up the mere corporeal semblance of the style; all its spirit, all its attractions, are gone. Richness seems to be quite out of the question, and soberness almost equally so, for notwithstanding the excessive parsimoniousness which betrays itself, there is also a good deal of vulgar jauntiness and spruceness, bad enough in itself, and thus rendered doubly odious. In some of these buildings a tawdry organ-case is the principal object, all the rest consisting only of base, coldly glaring white walls, pews and galleries, the altar itself being hardly noticeable, except on account of the meanness it displays. In short, it is to be feared that our new churches, taken generally, are not calculated to impress foreigners with any high opinion—I do not say, of our taste, but of our religious ardour, if the latter may be judged of from the externals of public worship.

IV. The Reformers have completely discomfited the Conservatives, if not in politics, most certainly in architecture. The poor Conservative Clubhouse now looks sulkier than ever, now that the rival edifice proudly displays itself in its full majesty. I gladly hail the Reform Clubhouse, as an auspicious omen of reform in architecture; it being likely to disgust with that vapid and poverty-stricken so called classical style, which at the best has given us little more than scraps and bits of Grecian architecture, and that chiefly as regards columns alone, since any thing with a shelf on top of it will, we find, do for an entablature. Good lack, my old friend Classicality, how strangely hast thou been cockneyfied since thou took up thy abode among us! It grieves one to think of it, and yet one cannot help laughing, either, at the grotesque figure thou makest in thy present costume, and what is the worst part of the business is, thou hast been thus fantastically tricked by those who all the while have professed the utmost respect for thee.

V. I was pleasingly surprized the other day by the sight of a very great rarity, namely, an architectural volume both amply and beautifully illustrated with engravings, though only a very few copies of the work was printed for distribution among the author's friends. The work appears to have been got up without the least regard to expence. and so far forms a most complete contrast to the blundering, ostentatious, niggardness manifested in the "privately printed" yet tolerably well known volume of Sir J. Soane's, containing a set of coarse and almost caricature prints, intended to show different parts of his own house. On such occasions there is no excuse whatever for stinginess, or anything like it, because a man had better keep his money in his pocket, than fling it away in purchasing for himself the reputation of being an extravagant hanks and a miserly spendthrift.

But I have not mentioned the name of the liberal-spirited individual who, in the work first alluded to, has so worthily illustrated the interior architecture of his paternal residence at Great Yarmouth—W. F. Palmer, Esq., F.S.A. Such an example ought to be made known as extensively as possible, for if there were a few more of the kind, it would not be amiss. If it be said it argues a mere mania, it is to be hoped that a mania of this kind will prove quite as catching as that which induces people to fling themselves off the Monument, to the extreme horror of those philanthropists who would read of their jumping into the Thames quite unconcernedly. Yet it is rather to be apprehended that architectural mania, amateur-mania, will never prove infectious in this country. The truth is, John Bull is likely to stick fast to his old monomania, which, in plain English, is literally a *money-mania*.

REEFING STEAM-BOAT PADDLES.

Fig. 1.

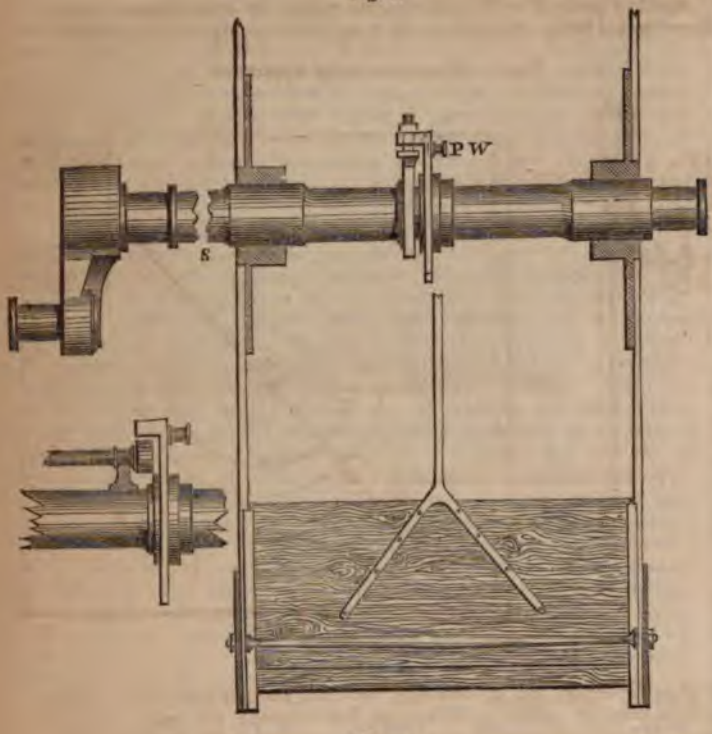
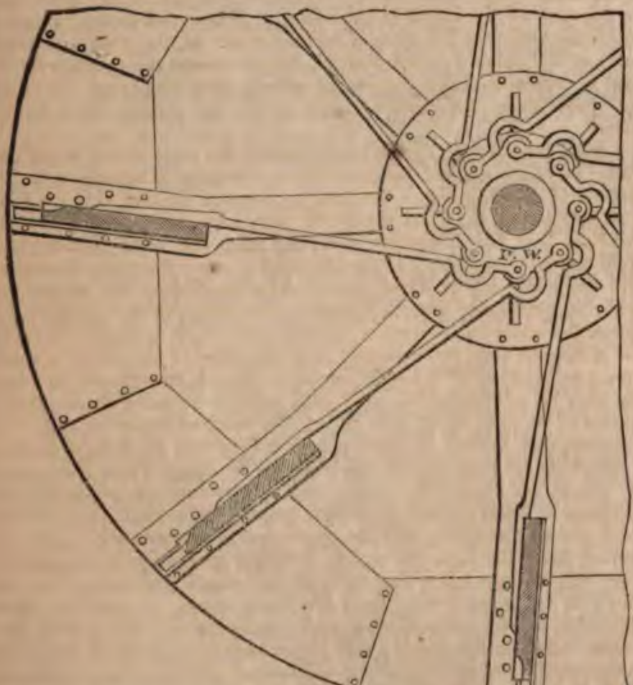


Fig.



P.W, Pivot wheel. S, Shaft.

Sir—Observing by some of the public journals that the reefing of steam-boat paddles is becoming a matter of interest, I take the liberty of sending a rough copy of a simple method executed by Messrs. Boulton, Watt & Co. for a vessel on the Tyne in the year 1815 (whose draught was variable,) it was found to answer well.

The extreme diameter when the boards were out, was 11 ft.; by the mode adopted, they could be drawn in 7½ in., reducing the diameter to 9 ft. 9 in., which was considered sufficient for a vessel of only 5 feet immersion.

By the application of a lever, the whole of the boards were moved at once, and fixed in the required position by a screw pin; this involved going into the paddle-box to make the adjustment previous to starting, but the operation is capable of being performed by a pinion working into the internal circumference of the pivot wheel (shewn in the small side figure), while the quantity of reefing may be carried to all necessary extent by enlarging its diameter.

It was the fashion in those early days of steam navigation to fit the wheels with shrouding, which, although not necessary to the scheme, I have chosen to show it as executed at that period. Should you consider this worthy of insertion, you will oblige, Sir;

Your constant reader,
T. Z.

London, 20th January, 1840.

PATENT IMPROVED BOILER OR APPARATUS FOR GENERATING STEAM.

The first part of my invention consists of an apparatus (after described) for causing water in the state of dew, or divided into very minute drops or particles, to descend slowly through the interior of the boiler or generator, upon the heated surface of which, so much of it as is not converted into steam during its descent, ultimately falls; by which means a less quantity of heat is abstracted during any given time from the heated surface, than if such surface were covered with a continuous sheet or film of water, or with a body of water, as in the common boiler. And by the means I adopt, I do not merely raise steam, by wetting the heated surface, but the boiler or generator when at work is filled by dew or water in a state of minute division, which in its descent, becomes partially converted into steam, by the heat of the atmosphere or vapour within the boiler itself.

I find that a temperature of 500° or thereabouts, of Fahrenheit, in the body or substance of the boiler or generator, is that best adapted to the purpose of raising steam.

Another part of my invention consists of a self-acting apparatus, (afterwards described) for regulating the supply of water to the generator or boiler, according to the condition of the heated surfaces, and the consequent force of the steam within the boiler, that is to say, that if the boiler contains a greater body of steam, or of greater elastic force, than is necessary for the wants of the engine or other purpose to which it may be applied, then by the self-acting apparatus before referred to, the stroke of the force or supply-pump is shortened, so that when the steam is high in the boiler, the quantity of water injected becomes proportionably less; by this means, if by any chance in consequence of the boiler becoming heated to redness, or to any other degree of heat which would be highly dangerous in other boilers, or from any other cause, steam of a violently elastic force be produced, its effect is, through the medium of the above regulating apparatus, to shorten, or totally shut off, the supply of water, until the surface becoming cooler, or producing steam of less elastic force, the pump is again allowed to act; such a case, however, can never happen, excepting after the engine has been standing still for some time, and when, by neglect or design, the usual precautions and attention bestowed upon other boilers have not been observed, as the damper regulator, which is somewhat similar in effect to those in present use, will always prevent the fire being in advance, or more powerful to heat the surfaces, than the water to cool them.

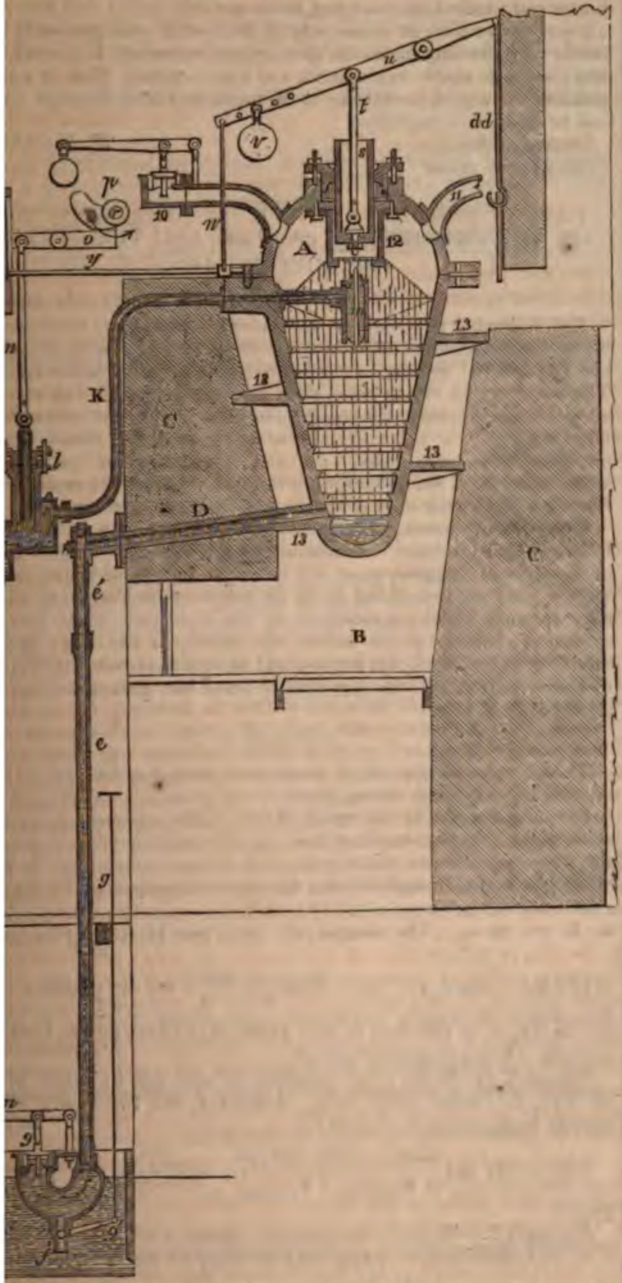
In applying this invention, it will be generally found desirable to keep that part of the surface of the boiler, exposed to the immediate and corrosive action of the fire, covered with water, by which means it will be prevented from burning, and another part of my invention consists in a self-acting apparatus adapted to attain this object. By this apparatus (which is hereinafter described) the water is prevented from accumulating in the boiler beyond the quantity found best in practice, and which, in the boiler I generally use, is from three to six inches in depth over the fire; this apparatus, at the same time that it prevents the water rising in the boiler beyond a certain limit, acts upon the force-pump in a way which will be presently described, so as to reduce the quantity of water injected, if necessary.

In applying my invention, I employ metal flues, by which means the fire is not only kept longer upon the surface, but the flues become carriers or depositaries of heat, and by radiation impart a certain portion of the effect of the fire upon them to the boiler, and thus economize fuel, besides adding to the strength of the boiler itself.

Another part of my invention consists in forming ridges in the interior of the boiler, by which the descent of the water over the surface is retarded, but which, although a great improvement to the action of the boiler, is not absolutely essential to it.

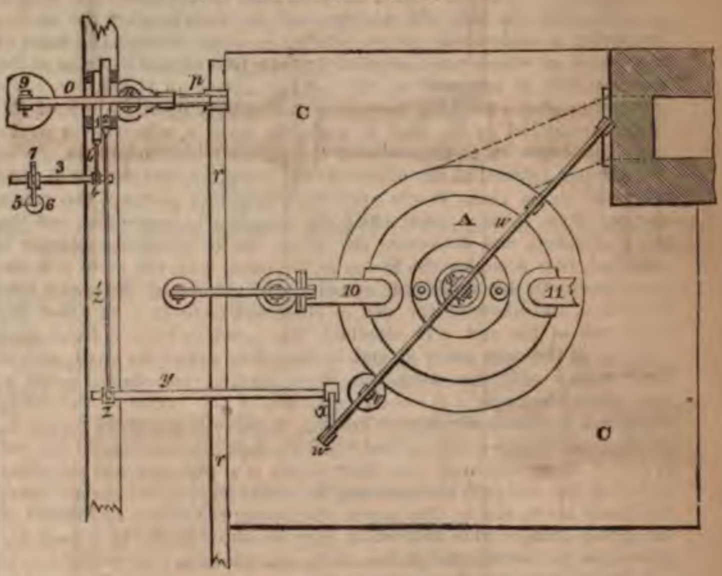
The external figure or shape which I have generally adopted as the best in practice, will be seen by the accompanying figure; but any ient form may be employed, and the fire may be either external wn in the figure, or internal according to the system usually d in steam-vessels.

Fig. 1.—Cross section.



ure 1 exhibits a cross section of the boiler, pump, and water- with a representation of the water-regulating apparatus. A is er, made of cast iron or other metal, around which is cast the flue 13, and having its interior formed into ridges or corrugated, ridges increase in width as they approach the bottom of the . B is the fire-place, C the brickwork in which the boiler is the water-pipe, by which the water in the boiler flows off as s it has risen to a level with the mouth of the pipe; the water lescends through the pipe *e e*, to the water-valve box *f*, and pass out into the cistern F if not kept back by the valve *g*; the *g* is loaded with weight *i*, and lever *h*, so that it resists the re of the steam, in the same way as the safety-valve 10; but the water accumulates in the descending pipe *e*, so that there e an altitude of water above the surface of the valve of from six feet, the valve will be unable to sustain the additional re of from two to three pounds per square inch upon its area, will lift and let out the water, until the descending column es the weight of the valve; the cock *f* is for the purpose of blowing out any sediment which may have accumulated in the valve box, this is done by depressing the rod *g g*, attached to the lever *g'*, which is fixed on the plug of the cock.

Fig. 2.—Water-regulating Apparatus.



Another mode of self-regulation for marine or other engines, when there would be an objection to the length of the pipe *e*, is as follows a pipe descends, and is connected with the suction-pipe of a pump, which may be either a bucket or force-pump; the exit valve or clack, is loaded by a weight and lever, like a safety-valve, with the same object as the water-valve already described, viz. that it may counteract the pressure of the steam in the boiler. When the pump is full of water, the action of the plunger will force out of the pump as much water as it displaces in its descent, and draw into the pump from the pipe a corresponding quantity of water, thus emptying the pipe, and preventing the water rising above its proper level in the boiler.

A glass tube is employed at *e'*, by which the state of the water may always be observed, and the usual brass mounting is attached, for the purpose of cleaning either the lying or vertical pipes; C is the force or supply-pump, the suction-pipe K' draws its supply from the cistern F, so that the hot water escaping from the boiler is used over again and no heat lost; *k* is the injection pipe of the pump connected with the nozzle *m*; at about one-third its length from the bottom, the nozzle is perforated with a circle of small holes, drilled so as to discharge the water in a direction slanting upwards, or in such a direction that it may be reflected upwards from the sides of the boiler or generator, (any number of holes in any figure which experience may suggest may be adopted), the best plan I find is to make them about a quarter of an inch apart, and about the hundredth part of an inch in diameter, and drilled in such way that they may be largest outside, by which means they will be less likely to be clogged up; the ends of the nozzle are loose, the upper end screws into its place, and the lower end is made a good joint and ground in, so that when the bolt which passes through it, and the upper end is screwed with a nut and spanner from the top, the nozzle becomes perfectly closed, and no water can escape excepting through the small perforations in the sides; it is necessary to form the ends loose, or provide some other adequate means to discharge the sediment, which may from time to time collect in the nozzle; this adjustment is easily made by merely taking out the plunger *s*, and the perforated plate *s'*, when a spanner can be introduced into the boiler, and the nut or upper end unscrewed as may be required; sometimes the nozzle is formed in a circle with jets like a gas burner, but the above described method I have found to be the best.

The action of the injected water is clearly seen by the dotted and prolonged descendieg lines, the water impinges violently against the sides of the vessel, and is then thrown off at an equal angle in an opposite direction, after which it descends in a vertical shower as shown, it is not necessary that this mode should be always observed, any mode is good that minutely divides the water, and then allows it to descend slowly upon the heated surfaces may be adopted to my invention; but it is essential that the water should be first discharged upwards, either in an inclined direction or perpendicularly, or that it should be discharged in such a direction that it may be reflected upwards, or slanting upwards from the sides of the boiler.

The plunger of the pipe C is connected by the link *n* with the lever *o*, this lever is worked by the cam *p*, fixed on the shaft *r*, which shaft is driven by any of the usual and suitable modes from the engine, or any other equivalent mode of lifting the lever may be adopted; to the end opposite to that on which the cam acts, is suspended the weight *q*, so that the cam lifts the plunger and the weight gives the stroke, producing a sudden and violent rush of the water through the holes of the nozzle *m* which very materially affects that minute division of the water which is necessary to the perfect action of the boiler, *s* is a plunger or piston working through a stuffing box, upon the top of the boiler connected by the link *t*, with the lever *u*, which lever works upon the centre *v*, to the end next the chimney is attached the rod of the damper *d d*, and to the other end the weight *v*, and the rod *w*, thus when the steam rises, it acts upon the plunger or piston *s*, this raises the end of the lever *n*, upon which the weight *v* is suspended, and the rod *w* attached, and depresses the other end to which the damper is attached, thus damping the fire as in the usual way, the lever *u* in the act of rising by the increasing elasticity or volume of the steam lifts the rod *w*, and likewise the end of the crank or lever *x*, to which the other end of the rod *w* is attached, this crank or lever is fixed upon one end of the cross shaft *y*, and to the other end of the shaft, and at right angles with the crank *x* is fixed another and shorter crank *z*, thus when the crank *x* is raised vertically by the action of the steam plunger *s*, it causes the shorter crank *z* to move horizontally forwards, this horizontal movement is continued through the medium of the rod or bar *z′*, connected with the short crank *z* at one end, and the other end with the wedge 2, thus pushing the wider part of the wedge under the pump lever, and by this means shortening the stroke or descent of the pump plunger, this movement may be also effected by a rack and pinion, or by a screw and pinion, or by other means.

I do not claim the plunger or piston as new, to regulate the damper, an analogous contrivance, having already been made; that part of my invention which I have before referred to as a self acting apparatus for preventing an undue accumulation of water in the bottom of the boiler, is as follows; to the extreme end of the lever *h*, of the water-valve, is fixed a slight bar, wire, or chain, 8; the other end of the wire or chain is connected to the short horizontal crank 7, fixed upon the short cross shaft 3; to the longer arm 5 of the horizontal crank, is suspended the weight 6, which weight, when the wire or chain is slackened, descends, and descending, produces motion in the shaft 3, to which the crank is fixed, and also in the short crank 4, fixed upon the other end of the cross shaft 3; thus as the weight descends, the crank 4, by means of the rod 4′, connected with it, and the wedge 1, draws the wedge 1 forward; by the wider part being thus drawn or introduced under the lever *o* of the pump, the stroke of the pump is shortened, and the supply of water consequently diminished. I do not confine myself to the particular modification of machinery here described for effecting this object, but any other adapted to the purpose may be used; thus for instance, another mode of regulating the action of the pump, is by forming the descending tube about 8 or 10 inches internal diameter, and placing therein a float, which shall rise and fall with the water in the tube in the same way as the float in the feed head of a common boiler regulates the damper, then a wire passing through a stuffing box in the upper part of the pipe *e*, and communicating with the crank 7, in the same way as the wire 8, the same movement will take place in the wedge 1, as has been before described; in the case of a locomotive where the pump plunger is connected with the cross head of the piston rod, and works very fast; the method to be adopted to reduce the stroke of the pump, will be to make the barrel of the pump moveable, then by means of a screw fixed to the end, and causing the nut in which the screw works to be acted upon either by the steam plunger or the lever of the water valve, and thus making the barrel of the pump advance towards, or recede from the plunger, the same regulating process will be easily applicable; it will be merely necessary that the suction and injection pipe should work in stuffing boxes, or by making them elastic to allow for the variation; 9 is the pipe and cock for supplying the water cistern with water, 9′ is the ball-cock which keeps the water to its level, 10 is the safety valve, 11 the steam pipe, 12 the steam casing in which the plunger works, the lower part is covered with a plate perforated with holes, so that the steam plunger may work more steadily, and not be acted upon so suddenly by the steam, as the steam before acting upon the plunger will pass through the holes of the plate, and thus a certain regularity of action will be preserved, which could not be ensured without it.

A boiler upon this construction, but made in a very rude manner for the purpose of experiment, 2 ft. deep, 1 ft. over at the bottom, and 2 ft. wide at the widest point, was at work for some time driving a 6 horse condensing engine at Messrs. Burton & Sons, engineers, Bankside, but now of Holland Street, Blackfriars Road; the area exposed to the fire was about 8 ft., and this drove the engine fully loaded, the steam blowing off during the greater part of the time; it had no tendency to get red hot, and upon several occasions, for the mere purpose of the experiment, the engine was stopped, and the boiler purposely made red hot, when the only result that followed was a rapid generation of steam whilst the water was pumped into the boiler; by this apparatus the great desideratum of a powerful, portable, and safe boiler is obtained, and I feel certain that in a properly constructed vessel, a velocity of 20 miles per hour through the water can be easily accomplished.

Stamford Street, W. J. CURTIS.
Blackfriars Road.

ON THE PRESSURE OF WATER AND THE STRENGTH OF COFFER-DAMS.

BY JOHN NEVILLE, C.E.

THE following prepositions are intended to furnish rules for calculating the dimensions of coffer dams from having the depth of water, and the specific gravity of the materials to be used in the dam given. The construction of the coffer dam is supposed to be that generally adopted, namely, two or more rows of piles having the spaces between filled with clay, or a mixture of clay and gravel, the whole united into one mass by walings, bolts, &c. And it will be seen that the dimensions found from the investigated formulæ do not differ materially from those adopted with success by many celebrated engineers.

The pressure arising from mere depth of water is not the only force to be prepared against in constructing a coffer dam, as moving water or an exposed situation must also be taken into consideration. These latter I have not calculated for in the following problems, as I consider they are sufficiently provided for by the resistance of the piles penetrating the bottom, which assists the solidity of the dam; and by the auxiliary aid of stays and braces, and have determined the dimensions of the dam itself as only sufficient to resist the pressure of an outside depth of dead water.

PROBLEM I.

To determine the amount of pressure against a coffer dam or obstruction, the depth of water being given.

Put c for the depth of water in feet. The pressure on each point of the dam is as the depth of that point from the surface of the water; the whole pressure for the depth c is therefore represented by the area of a right angled triangle having the base and perpendicular each equal to c, or by $\frac{c^2}{2}$. The weight of a cubic foot of water may be taken at 62½ lbs.; hence we have $62\tfrac{1}{2}\times\frac{c^2}{2}=\frac{125c^2}{2}$ for the pressure on each foot in length of the dam in lbs., which, multiplied by the length, will give the whole pressure required.

Example 1.—What is the pressure on each foot in length of a coffer-dam, the water inside being exhausted, and the depth of water outside being equal to 15 feet?

Here $c=15$ and $\frac{125c^2}{2}=\frac{125\times15\times15}{2}=14062\tfrac{1}{2}$ lbs., the pressure required.

Example 2.—What is the pressure against a coffer dam whose girth is 60 feet, the depth of water outside being 20 feet?

Here we have $\frac{125\times20\times20}{2}=25000$ lbs. for the pressure on each foot in length, therefore $25{,}000\times60=1{,}500{,}000$ lbs. is the pressure required.

PROBLEM II.

To find the effective pressure against a coffer dam or lock gate, the depth of water outside being given: a given depth of water being inside.

Put c for the outside depth of water, and d for that inside, we then get $\frac{125c^2}{2}-\frac{125d^2}{2}=\frac{125\,(c^2-d^2)}{2}=\frac{125\times(c+d)\times(c-d)}{2}$ for the pressure on each foot in length, when the inside and outside girths are equal; putting therefore g for either girth, we get $\frac{125\times(c+d)\times(c-d)\times g}{2}$ for the pressure required.

Example 1.—Given the depth of water on the outside of a dam equal 20 feet, that inside equal 6 feet, and the girth 60 feet, what is the effective pressure against the dam?

We have $c+d=26$, $c-d=14$, and $g=60$ therefore

$$\frac{125\times(c+d)\times(c-d)\times g}{2}=\frac{125\times26\times14\times60}{2}=125\times26\times14\times30$$

$=45,500\times30=1,365,000$ lbs. for the effective pressure.

When the inside and outside girths differ, by putting g for the outside girth, and g' for that inside, we get in this case $\frac{125(c^2g-d^2g')}{2}$ for the effective pressure.

Example 2.—Given the height of water on the sill to the upper gates of a lock above, 10 feet and girth 24 feet; below 4 feet and girth 25 feet—what is the effective pressure on the gates?

The pressure is equal $\frac{125(c^2g-d^2g')}{2}=\frac{125(100\times24-16\times25)}{2}$ $=125(100\times24-8\times25)=125\times1000=125,000$ lbs. the pressure required.

Example 3.—Find the effective pressure against a coffer dam, the exterior depth and girth respectively being 27 and 120 feet; and the interior depth 5 feet, and girth 100 feet.

Here by the formulæ $\frac{125(27\times27\times120-5\times5\times100)}{2}=$ $125(729\times60-25\times50)=125\times424,90=5,311,250$ lbs. the pressure required.

PROBLEM III.

To find the centre of pressure in a given depth of water: or that point where the force of the whole pressure is equal to the sum of the forces arising from the pressures at different depths from the surface.

The whole pressure (problem 1) is represented by a right angled triangle having its base and perpendicular each equal to the depth of water, and as the pressure at each point along the depth is proportional to the depth of such point from the surface, or which is the same thing to a line parallel to the base at that point meeting the hypothenuse; the centre of pressure is evidently on the same horizontal line with the centre of gravity of the triangle. But the latter is at one third of the perpendicular from the base, therefore the centre of pressure is at one-third of the depth of water from the bottom, or $\frac{1}{3}c$.

Examples. The centre of pressure in 15 feet of water is 5 feet above the bottom: in 18 feet of water at 6 feet above the bottom: and in 30 feet of water at 10 feet above the bottom.

PROBLEM IV.

To find the centre of pressure when given depths of water are inside and outside a coffer-dam.

By putting as before c for the depth outside, and d for that inside, we find the outside pressure acting at the distance $\frac{1}{3}c$ from the bottom equal $\frac{125c^2}{2}$ (problems 1 and 3), and the inside pressure acting at the distance $\frac{d}{3}$ equal $\frac{125d^2}{2}$. The centre of pressure is now therefore in the fulcrum of a lever, whose length is $\frac{c-d}{3}$, which lever is acted on at its ends by the two pressures $\frac{125c^2}{2}$ and $\frac{125d^2}{2}$. To find this point we have $\frac{125c^2}{2}+\frac{125d^2}{2}:\frac{c-d}{3}::\frac{125d^2}{2}:\frac{(c-d)\times d^2}{3(c^2+d^2}$ the distance of the fulcrum from a point corresponding to $\frac{1}{3}c$, therefore $\frac{c}{3}-$ $\frac{(c-d)\times d^2}{3(c^2+d^2)}=\frac{c^3+cd^2-cd^2-d^3}{3(c^2+d^2)}=\frac{c^3+d^3}{3(c^2+d^2)}$. The distance of the point required from the bottom of the water from which we deduce the following rule:—

Divide the sum of the cubes of the inside and outside depths by three times the sum of their squares, the quotient will be the distance of the centre of pressure from the bottom of the water.

Example.—Take $c=20$ and $d=10$ we then have $\frac{20^3+10^3}{3(20^2+10^2)}=\frac{8000+1000}{3\times500}=\frac{9000}{1500}=6$ feet for the distance of the centre of pressure from the bottom.

PROBLEM V.

To find the centre of pressure in a depth of water lying between the depths c and d below the surface.

Let c be the greater depth, and put x for the distance of the centre of pressure in the depth $c-d$, from the centre of pressure in the depth c; we then have from the properties of the lever

$$x\times\frac{125(c^2-d^2)}{}=\frac{2(c-d)}{3}\times\frac{125d^2}{2},$$

from which equation by an easy reduction we find $x=\frac{2d^2}{3(c+d)}$ therefore $\frac{c}{3}-\frac{2d^2}{3(c+d)}$ is the distance of the point required from the bottom of the depth c, and $\frac{2c}{3}+\frac{2d^2}{3(c+d)}$ its distance from the surface of the water.

Example 1.—In 15 feet depth of water what is the distance of the centre of pressure of the lowest 5 feet from the bottom?

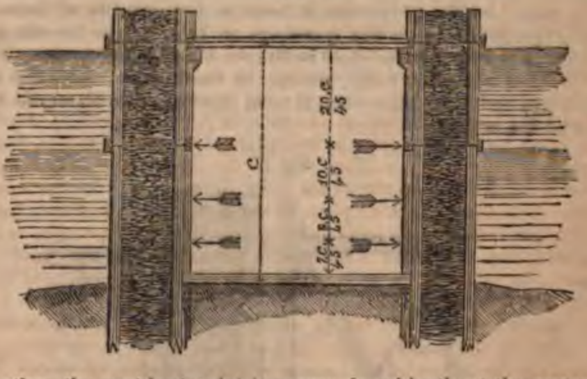
Here $\frac{c}{3}=5$ and $\frac{2d^2}{3(c+d)}=\frac{2\times10^2}{3\times(15+10)}=\frac{200}{75}=\frac{8}{3}$ feet, therefore $\frac{c}{3}-\frac{2d^2}{3(c+d)}=5-\frac{8}{3}=\frac{7}{3}$ feet the distance required.

Example 2.—Two stays support a coffer-dam at depths of 20 and 10 feet below the surface of the water, and it being found necessary to place another between these, at what distance shall we place it from the lower stay, so that it may afford the greatest assistance possible?

It is easy to see that the third stay must be applied opposite the centre of pressure. To find this point we have $c=20$ and $d=10$, therefore $\frac{c}{3}-\frac{2d^2}{3(c+d)}=\frac{20}{3}-\frac{\overline{2\times10}^2}{3(20+10)}=\frac{20}{3}-\frac{200}{90}=\frac{20}{3}-\frac{20}{9}=\frac{60-20}{9}$ $=\frac{40}{9}=\frac{44}{9}$ feet, the distance required.

A proper knowledge of the position of the centre of pressure will enable us to place our stays with advantage and economy, particularly in those cases where a coffer-dam is surrounded with water. If the top and bottom of such a coffer-dam (fig. 1) are kept from approaching each other, the next best point to secure is evidently at the centre of pressure of the whole depth of water, or using the same notation as before at $\frac{1}{3}c$ from the bottom. If more stays are necessary, the most important points to be secured are those at the distance $\frac{7c}{45}$ and $\frac{5c}{9}$ from the bottom, or in other words at the points corresponding to the centres of pressure in the lower and upper portions of the depth $\frac{c}{3}$ and $\frac{2c}{3}$.

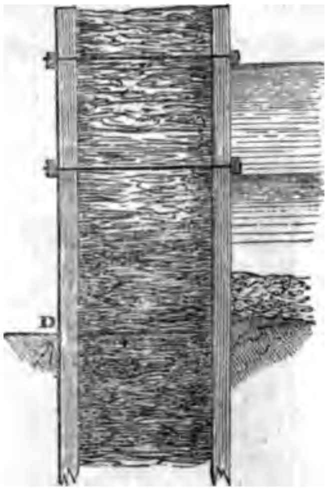
Fig. 1.



PROBLEM VI.

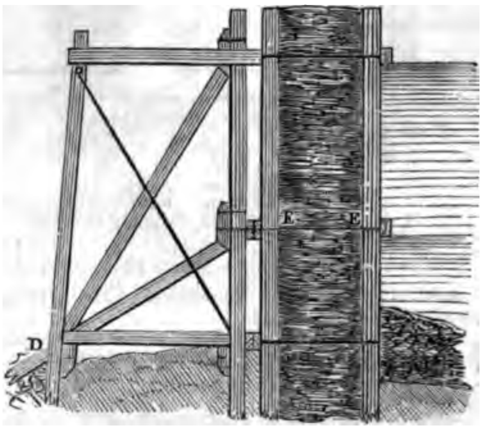
To find the dimensions of a coffer-dam fig. 2 sufficient to resist the pressure of a given depth of water when the section is rectangular.

Fig. 2.



Put s for the mean weight in lbs. of a cubic foot of the materials in the dam, b for its height in feet, d for its width in feet, and c for the depth of high water in feet. We then have $b\,d\,s$ equal the weight of one foot in lenght. It is evident that the dam fails only when the force of the water is able to turn it round the point D, and as the weight $b\,d\,s$ acts at the distance $\frac{d}{2}$ from D in the figure its force is properly represented by $b\,d\,s \times \frac{d}{2} = \frac{b\,d^2 s}{2}$. The pressure of the water is equal $\frac{125c^2}{2}$ (problem 1,) which acting at the distance $\frac{c}{3}$ above D (problem 3) has its force represented by $\frac{125c^2}{2} \times \frac{c}{3} = \frac{125c^3}{6}$. Therefore in case of equilibrium we have $\frac{b\,d^2 s}{2} = \frac{125c^3}{6}$ from which equation we find $d^2 = \frac{125c^3}{3\,b\,s}$ and $d = \sqrt{\frac{125c^3}{3\,b\,s}}$. From this proposition it is clear that when $b=c$, *the width d of the dam is proportional to the depth of the water, and that the power of water to overturn a dam is as the cube of its depth.* The value of s will depend on the nature of the puddle used in the dam, and the proportion it bears to the quantity of timber and iron in the width d. In the examples to this and the following problems, s is supposed to be equal to 90 lbs., which in most cases may not be far from the true value, except in those cases where the water penetrates under the dam when it must be reduced to about one-third, or to 30 lbs. nearly.

Fig. 3.



Example 1.—Find the width of a coffer-dam sufficient to resist the pressure of 17 feet of water on the outside, the height of the dam being 19 feet.

Here we have

$$d=\sqrt{\frac{125c^3}{3\,b\,s}}=\sqrt{\frac{125\times17^3}{3\times19\times90}}=\sqrt{\frac{614125}{5130}}=\sqrt{116{\cdot}4}=10{\cdot}8 \text{ feet.}$$

If $b=c=17$ feet, then $d=17\sqrt{\frac{125}{270}}=11{\cdot}6$ feet. If we suppose from want of proper precaution the water to penetrate under the dam, s is reduced to about $\frac{s}{3}$ for the height c, say $\frac{s}{n}$, we then get

$(b-c)\,ds+cd\times\frac{s}{n}\times\frac{d}{2}=\frac{125c^3}{6}$ for the equation of equilibrium from which we find $d^2\times(3\,nbs+3cs-3\,ncs) = 125c^3 n$ and

$d=\sqrt{\frac{125nc^3}{3\,nbs+3\,cs-3\,ncs}}$. When $n=3$ as would be nearly the case in practice, $d=\sqrt{\frac{125c^3}{s\times(3b-2c)}}$. By using the numbers in example 1, we get by this formulæ

$$d=\sqrt{\frac{125\times17^3}{90\times(57-34)}}=\sqrt{\frac{614125}{2070}}=\sqrt{296{\cdot}7}=17{\cdot}2 \text{ feet,}$$ shewing

under these circumstances a necessary increase of nearly six feet in width.

Example 2.—What width of dam is sufficient to resist the pressure of 17 feet depth of water, the dam to rise 4 feet above the surface, when the bottom is porous gravel communicating with the water.

In this case we have

$$d=\sqrt{\frac{125c^3}{90(3\,b-2\,c)}}=\sqrt{\frac{125\times17^3}{90\times(63-34)}}=\sqrt{\frac{614125}{90\times29}}=\sqrt{\frac{614125}{2610}}=\sqrt{235{\cdot}3}=15{\cdot}3 \text{ feet.}$$

Problem VII.

To find the strength of a coffer-dam (fig. 3) sufficient to resist the pressure of a given depth of water so that by the intervention of stays, &c. the coffer-dam could only fail by the failure of the point D.

Put k for the distance E D, d for the distance E F, and by using the same notation as before for the other dimensions, we get by the properties of the lever $bds\times(\frac{d}{2}+k)=\frac{125c^2}{2}\times\frac{c}{3}$ for the equation of equilibrium, and by reduction $d^2+2\,kd=\frac{125c^3}{3\,bs}$ from which we find

$$d=\sqrt{\frac{125c^3}{3\,bs}+k^2}-k.$$

Example 1.—Find the width d when $k=18$, $c=17$, and $b=21$ feet,

here $\sqrt{\frac{125c^3}{3\,bs}+k^2}-k=\sqrt{\frac{125\times17^3}{3\times21\times90}+18^2}-18=\sqrt{\frac{614125}{5670}+32{\cdot}4}-18=\sqrt{649}-18=25{\cdot}5-18=7{\cdot}5 \text{ feet}=d$. These were nearly the dimensions of the coffer-dam for building the river wall at the New Houses of Parliament (see Journal, vol. 1, page 31). But this coffer-dam was still held more firmly on its base by the resistance to the piles penetrating the silth and clay substratum requiring a considerable force to overcome it, over and above that which was already sufficiently resisted by the upper portion of the coffer-dam.

When d is given we find from the equation $d^2+2\,dk=\frac{125c^3}{3\,bs}$,

$$k=\frac{125c^3}{6\,bsd}-\frac{d}{2}.$$

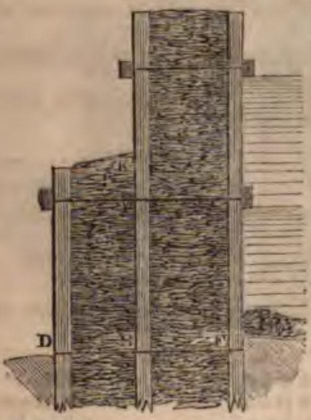
Example 2.—At what distance from the inner sheet pileing of a coffer-dam 10 feet wide shall we place the brace pileing D, so that when properly braced the dam shall resist the pressure of 30 feet depth of water outside. The dam rising 4 feet above the surface.

Here $k=\frac{125\times30^3}{6\times34\times90\times10}-\frac{10}{2}=\frac{3375000}{183600}-5=18{\cdot}4-5=13{\cdot}4$ feet the distance required. If $s=30$ as would be nearly the case if the bottom was porous, k should be increased to about $3\times18{\cdot}4-5=55{\cdot}2-5=50$ feet. This shows the importance of securing the bed of the dam from water by dredging, or otherwise clearing away all porous materials.

PROBLEM VIII.

To find the strength of a dam (form fig. 4) sufficient to resist the pressure of a given depth of water.

Fig. 4.



By using the same notation as before, putting f for E K, and k for D E, we get $s\,b\,d\times(\frac{d}{2}+k)+s\,k\,f\times\frac{k}{2}=\frac{125c^2}{2}\times\frac{c}{3}$ for the equation of equilibrium from which $s\,b\,d^2+2\,s\,b\,d\,k+s\,f\,k^2=\frac{125c^3}{3}$. This equation gives us $d^2+2\,d\,k=\frac{125c^3}{3\,bs}-\frac{k^2f}{b}$ and $k^2+\frac{2\,b\,d}{f}k=\frac{125c^3}{3\,sf}-\frac{b\,d^2}{f}$. From these we find $d=\sqrt{\frac{125c^3}{3bs}+\frac{(b-f)k^2}{b}}-k$ (1), and

$k=\sqrt{\frac{125c^3}{3sf}-\frac{b\,d^2}{f}+\frac{b^2\,d^2}{f^2}}-\frac{bd}{b}$. (2). From these values for d and k we can find one when the other is given.

Example 1.—Having given $k=4$ feet, $f=10$ feet, $b=21$ feet, and $c=17$ feet, to find the value of d?

By equation (1) $d=\sqrt{\frac{125c^3}{3bs}+\frac{(b-f)k^2}{b}}-k=\sqrt{\frac{614125}{5670}+\frac{176}{21}}-4=\sqrt{108{\cdot}3+8{\cdot}4}-4=\sqrt{116{\cdot}7}-4=10{\cdot}8-4=6{\cdot}8$, or 7 feet nearly, the value required.

Example 2.—Suppose $k=10$ feet, $f=17$ feet, $b=33$ feet, and $c=30$ feet, what is the width (d) equal to?

Here $d=\sqrt{\frac{125\times30^3}{3\times33\times90}+\frac{16\times10}{33}}-10=\sqrt{\frac{12500}{33}+\frac{1600}{33}}-10=\sqrt{\frac{14100}{33}}-10=\sqrt{427{\cdot}3}-10=20{\cdot}7-10=10{\cdot}7$ feet, the width required.

Example 3.—To find the value of k when $d=6$ feet, the other dimensions remaining the same as in Example 1.

From equation (2) $k=\sqrt{\frac{125c^3}{3sf}-\frac{b\,d^2}{f}+\frac{b^2d^2}{f^2}}-\frac{bd}{f}=$

$\sqrt{\frac{614125}{2700}-\frac{756}{10}+\frac{15876}{100}}-\frac{126}{10}=\sqrt{227{\cdot}5-75{\cdot}6+158{\cdot}8}-12{\cdot}6=$

$\sqrt{310{\cdot}7}-12{\cdot}6=17{\cdot}6-12{\cdot}6=5$ feet, the value sought.

Example 4.—To find the value of k when $d=10$ feet, the other dimensions remaining the same as in Example 2.

Here $k=\sqrt{\frac{125\times30^3}{3\times90\times17}-\frac{33\times10^2}{17}+\frac{33^2 10^2}{172}}-\frac{33\times10}{17}=$

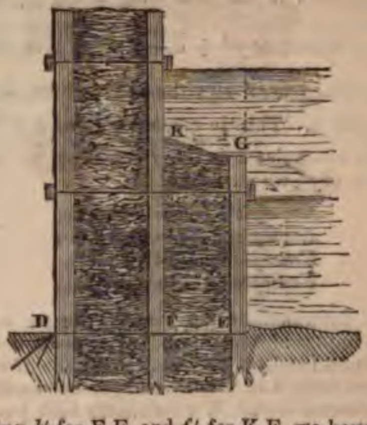
$\sqrt{\frac{12500-3300}{17}+\frac{108900}{289}}-\frac{330}{17}=\sqrt{541{\cdot}2+376{\cdot}8}-19{\cdot}4=$

$\sqrt{918}-19{\cdot}4=30{\cdot}3-19{\cdot}4=10{\cdot}9$ feet, the value sought.

PROBLEM IX.

To find the strength of a coffer-dam fig. 5, sufficient to resist the pressure of a given depth of water.

Fig. 5.



Here, by putting k' for F E, and f' for K F, we have

$$\left(\frac{k'}{2}+d\right)\times s\,k'f'+\frac{d}{2}\times s\,d\,b=\frac{125\,c^2}{2}\times\frac{c}{3},$$

for the equation of equilibrium by disregarding the vertical pressure of the water above K G, and thence $s\,k'^2f'+2\,s\,d\,k'f'+d^2s\,b=\frac{125c^3}{3}$; from this equation we get

$$d^2+\frac{2\,k'f}{b}d=\frac{125\,c^3}{3\,bs}-\frac{k'^2f'}{b}$$

$$\text{and } k'^2+2\,d\,k'=\frac{125\,c^3}{3\,sf'}-\frac{d^2\,b}{f'}\text{; these equations give}$$

$$d=\sqrt{\frac{125\,c^3}{3\,s\,b}-\frac{k'^2f'}{b}+\frac{k'^2f'^2}{b^2}}-\frac{k'f'}{b}\qquad(1).$$

$$\text{and } k'=\sqrt{\frac{125\,c^3}{3\,sf'}-\frac{b\,d^2}{f'}+d^2}-d\qquad(2).$$

Example 1.—When k' is equal 4 feet, what is the value of d, the other dimensions being the same as those in example 1, problem 8.

From equation (1) $d=\sqrt{\frac{125\times17^3}{3\times90\times21}-\frac{4^2\times10}{21}+\frac{10^2\times4^2}{21^2}}$

$$-\frac{10\times4}{21}=\sqrt{\frac{614{,}125}{5670}-\frac{160}{21}+\frac{1600}{441}}-\frac{40}{21}$$

$$=\sqrt{108{\cdot}3-7{\cdot}6+3{\cdot}6}-1{\cdot}9-\sqrt{104{\cdot}3}-1{\cdot}9$$

$$=10{\cdot}2-1{\cdot}9=8{\cdot}3\text{ feet.}$$

Example 2.—Using the same dimensions as in example 2, problem 8, what is the value of d?

$$d=\sqrt{\frac{125\times30^3}{3\times33\times90}-\frac{10^2\times17}{33}+\frac{10^2\times17^2}{33^2}}-\frac{10\times17}{33}$$

$$=\sqrt{\frac{12{,}500-1700}{33}+\frac{28{,}900}{1089}}-5{\cdot}2=$$

$\sqrt{327{\cdot}3+26{\cdot}5}-5{\cdot}2-\sqrt{353{\cdot}8}-5{\cdot}2=18{\cdot}9-5{\cdot}2=13{\cdot}7$ feet.

Example 3.—Using the same dimensions as those in example 3, problem 8, what is the value of k?

From equation (2) $k=\sqrt{\frac{125\times17^3}{3\times90\times10}-\frac{21\times6^2}{10}+6^2}-6$

$=\sqrt{227{\cdot}5-75{\cdot}6+36}-6=\sqrt{187{\cdot}9}-6=13{\cdot}7-6=7{\cdot}7$ feet.

Example 4.—Using the same dimensions as those for example 4, problem 8, what is the value of k'?

$$k'=\sqrt{\frac{125\times30^3}{3\times90\times17}-\frac{10^2\times33}{17}+10^2}-10$$

$$=\sqrt{\frac{12{,}500-3300}{17}+100}-10=\sqrt{\frac{9200}{17}+100}-10$$
$$=\sqrt{541\cdot2+100}-10=25\cdot3-10=15\cdot3 \text{ feet.}$$

If we take into consideration the weight of the water above K G, the values found for d and k in the examples are too high; but the gravity of the materials in the dam being to the gravity of the water as s to $62\frac{1}{2}$, if we substitute $f'+\overline{c-f}\times\frac{2s}{125}$, or $f'+\overline{c-f'}\times\frac{2}{3}$ (nearly), for f' in the general equations (1) and (2), we will find correct values for d and k. Thus in examples 1 and 3, $f'=10+\overline{17-10}\times\frac{2}{3}=\frac{44}{3}$, and in examples 2 and 4, $f'=17+\overline{30-17}\times\frac{2}{3}=\frac{77}{3}$; using these values of f' we would find in

Example 1.—$d=7\cdot4$ feet;
Example 2.—$d=11\cdot2$ feet;
Example 3.—$k=5\cdot9$ feet;
Example 4.—$k=11\cdot4$ feet;

all of which are intermediate between the former values and those found in the examples of problem 8. It appears therefore in these examples that fig. 4 is to be prefered to fig. 5. If we wish to have equal strength in these two forms, we get by equating the general equations in problems 8 and 9, $s\,b\,d^2+2\,s\,b\,d\,k+s\,k^2f=s\,k'^2f'+2\,s\,d\,k'f'+d^2s\,b$, and thence $2\,b\,d\,k+k^2f=k'^2f'+2\,d\,k'f'$, which equation will furnish the value of any of the quantities when the others are given. By substituting $f'+\frac{2c-2f'}{3}=\frac{2c+f'}{3}$ for f', we take into consideration the weight of water over K G; in assisting the stability of the dam Fig. 5, this substitution gives us $6\,b\,d\,k+3\,k^2f=2\,c\,k'^2+4\,c\,d\,k'+(k'^2+2\,d\,k')f'$, for a general equation of equal strength in both forms.

The subject we have now been considering, is closely connected with the consideration of the comparative strength of buttresses and contreforts to retaining walls. If we put n for the weight of a cubic foot of earthwork or filling, and s for that of masonry, and substitute $f'\times\frac{\overline{c-f'}\times n}{s}$ for f' in the equation $2\,bdk+k^2f=2\,dk'f'+k'^2f'$, we get $2\,bdsk'+k^2fs=(k'^2+2\,dk')\times\frac{nc+(s-n)f'}{s}$ for a general equation of equal stability between buttress and contrefort, by which we may with ease determine any of the dimensions by having the others given, as none of the quantities rise higher than the second power. The quantity $\frac{\overline{c-f'}\times n}{s}$ is the height of a prism of masonry equal in weight to a prism of clay whose height is $c-f$. This prism acts with the clay or filling in moving out the wall, and also, from its weight on the contrefort, gives the latter greater stability. This double action often separates the contrefort from the main wall when both are not well bonded into each other.

Having pointed out the method of taking the weight over K G, Fig. 5 into account, where considered necessary, we will neglect it in the examples to the following problem, though the formulæ are general by substituting $\frac{2c+f'}{3}$ for f'.

PROBLEM X.

To find the dimensions of a coffer-dam, Fig. 6, sufficient to resist the pressure of a given depth of water.

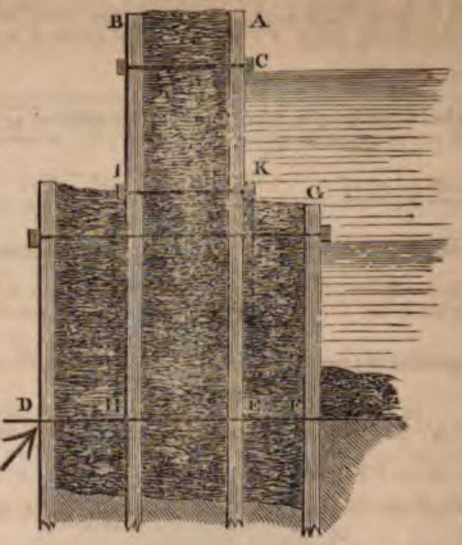
By observing the same notation as in the former problems, we get from the principles of the lever,

$$sf'k'+(k+d+\frac{k'}{2})+s\,b\,d\times(k+\frac{d}{2})+sfk\times\frac{k}{2}=\frac{125c^2}{2}\times\frac{c}{3}$$

for the equation of equilibrium, and by reduction we find $2\,k\,k'f'+2\,k'f'd+k'^2f'+2\,k\,d\,b+b\,d^2+fk^2=\frac{125\,c^3}{3s}=m\,c^3$ by putting $m=\frac{125}{3s}$. From this equation we find

$$d^2+\frac{2\,k'f'+2\,k\,b}{b}\times d=\frac{mc^3-2\,k\,k'f'-k'^2f'-k^2f}{b};$$

Fig. 6.



A B$=d$
B H$=b$
C E$=c$
I H$=f'$
H D$=k$
FE$=k'$
K E$=f$.

$$k^2+\frac{2\,b\,d+2\,k'f'}{f}\,k=\frac{m\,c^3-2f'\,d\,k'-f'\,k'^2-b\,d^2}{f};$$

$$\text{and } k'^2+(2\,d+2\,k)\,k'=\frac{mc^3-2\,bdk-f\,k^2-b\,d^2}{f'}.$$

From these equations we find, by quadratics, the following general values for d, k and k'.

$$d=\sqrt{\frac{mc^3-2\,k\,k'f'-f'k'^2-f\,k^2}{b}+\overline{\frac{k'f'+kb}{b}}\Big|^2}-\frac{k'f'+kb}{b} \quad (1).$$

$$k=\sqrt{\frac{mc^3-2\,df'k'-f'k'^2-bd^2}{f}+\overline{\frac{bd+k'f'}{f}}\Big|^2}-\frac{bd+k'f'}{f} \quad (2).$$

$$k'=\sqrt{\frac{mc^3-2\,bdk-f\,k^2-bd^2}{f'}+\overline{d+k}|^2}-d-k \quad (3).$$

When $f=f'$, as is generally the case in practice, we get by a simple reduction,

$$d=\sqrt{\frac{mc^3-f\times(k+k'^2)}{b}+\overline{\frac{k'f+kb}{b}}\Big|^2}-\frac{k'f+kb}{b} \quad (4).$$

$$k=\sqrt{\frac{mc^3-(2\,dk+k^2)f-bd^2}{b}+\overline{\frac{ba+k'f}{b}}\Big|^2}-\frac{bd+k'f}{b} \quad (5).$$

$$k'=\frac{mc^3-(b-f)\times(d^2+2\,dk)}{b}-d-k \quad (6).$$

from which equations, by having any two of the widths a, k, and k' given, the other may be found.

Example 1.—Required the width of the main dam in Fig. 6, the depth of the water to be resisted being 30 feet, and the other dimensions as follows, viz. $f=f'=17$ feet; $k=7$ feet; $k'=10$ feet; and $b=33$ feet.

By equation (4) we have

$$d=\sqrt{\frac{\frac{125}{270}\times30^3-17\times17^2}{33}+\overline{\frac{10\times17+10\times33}{33}}\Big|}-\frac{10\times17+7\times33}{33}=\sqrt{\frac{12{,}500-4913}{33}-\overline{\frac{401}{33}}\Big|^2}-\frac{401}{33}=$$

$\sqrt{229\cdot9+147\cdot6}=12\cdot2=\sqrt{377\cdot5}-12\cdot2=19\cdot4-12\cdot2=7\cdot2$ ft. which nearly corresponds with the width of the principal dam in the coffer-dam used by Telford for building St. Katherine's docks, the other dimensions being taken from the transverse section given in the *Journal*, page 433, Vol. II.

Example 2.—Other dimensions remaining the same as in the last example, what is the value of k when d and k' are each equal to 7 ft.

From equation (5)

$$k = \sqrt{\frac{12{,}500 - 17 \times (2 \times 17 \times 7 + 7^2) - 33 \times 7^2}{17} + \frac{\overline{7 \times 33 + 7 \times 17}|^2}{17}} - \frac{7 \times 33 + 7 \times 17}{17} = \sqrt{\frac{12500 - 2499 - 1617}{17} + \frac{350}{17}} - \frac{350}{17} =$$

$$\sqrt{493{\cdot}2 + 424{\cdot}3} - 20{\cdot}6 = \sqrt{917{\cdot}5} - 20{\cdot}6 = 30{\cdot}3 - 20{\cdot}6 = 9{\cdot}7 \text{ feet.}$$

Example 3.—Other dimensions remaining the same as those in example 1, what is the value of k' when $d = 7$ feet and $k = 9$ feet?

From equation (6) we have $k' = \sqrt{\frac{12500 - 16 \times (7^2 + 126)}{17}} - 7$

$$- 9 = \sqrt{\frac{12{,}500 - 2800}{17}} - 16 = \sqrt{\frac{9700}{17}} - 16 = \sqrt{570{\cdot}6} - 16$$

$= 23{\cdot}9 - 16 = 7{\cdot}9$ feet.

When $f = f'$ and also $k = k'$, we find from equation (4) by a few easy reductions

$$d = \sqrt{\frac{m c^3}{b} + \frac{\overline{(b - f)\, k}|^2}{b}} - \frac{(f + b) \times k}{b} \qquad (7).$$

also from the general equation of equilibrium, $2 k^2 f + 2 k f d + k^2 f + 2 k d b + b d^2 \times f k^2 = m c^3 = 4 k^2 f + 2 k f d + 2 k d b + b d^2$, from which $k^2 + \frac{b d + d b}{2 f} k = \frac{m c^3 - b d^2}{4 f}$, and by quadratics,

$$k = \sqrt{\frac{m c^3}{4 f} + \frac{\overline{(b - f) \times d}|^2}{4 f}} - \frac{(b \quad f)\, d}{4 f} \qquad (8).$$

Example 4.—Required the width of the main dam in fig. 6, the depth of water being 30 feet, and the other dimensions as follows, viz. $k' = k = 8$ feet, $f = f' = 15$ feet, and $b = 34$ feet.

From equation (7) $a = \sqrt{\frac{12{,}500}{34} + \frac{\overline{(34 - 15)\, 8}|^2}{34}} - \frac{(34 + 15)\, 8}{34}$

$$= \sqrt{\frac{12{,}500}{34} + \frac{23{,}104}{1156}} - \frac{392}{34} = \sqrt{367{\cdot}7 + 20} - 11{\cdot}5 = \sqrt{387{\cdot}7}$$

$- 11{\cdot}5 = 19{\cdot}7 - 11{\cdot}5 = 8{\cdot}2$ feet, the width required.

Example 5.—What is the value of $k = k'$ when the depth of water is 27 feet $f = 15$ feet, $b = 30$ feet, and $d = 6$ feet?

From equation (8) $k = \sqrt{\frac{\frac{125}{270} \times 27^3}{60} + \frac{\overline{30 - 15 \times 6}|^2}{60}} - \frac{45 \times 6}{60}$

$$= \sqrt{\frac{91{,}125}{600} + \frac{9}{4}} - 4{\cdot}5 = \sqrt{151{\cdot}9 + 2{\cdot}2} - 4{\cdot}5 = \sqrt{154{\cdot}1}$$

$- 4{\cdot}5 = 12{\cdot}4 - 45 = 7{\cdot}9.$

Example 6.—What width shall we adopt for the main dam, the depth of the water being 18 feet, when $k = k' = 5$ feet, $f = f' = 12$ feet, and $b = 21$ feet?

$$d = \sqrt{\frac{\frac{25}{270} = 18^3}{21} + \frac{\overline{(21 - 12) \times 5}|^2}{21}} + \frac{(21 + 12) \times 5}{21}$$

$$= \sqrt{\frac{2700}{21} + \frac{2025}{441}} - \frac{165}{21} = \sqrt{128{\cdot}6 + 4{\cdot}6} - 7{\cdot}9 = \sqrt{133{\cdot}2} - 7{\cdot}9$$

$= 3{\cdot}6$ feet, the width required. If $s = 80$ lbs., we would find $d = 4{\cdot}3$ feet; and if s was still farther reduced to 60 lbs., d would require to be increased to 6·1 feet.

It appears that the value of s in the foregoing formulæ greatly operates on the result in finding the width of the coffer-dam under its different forms. Unless where otherwise mentioned it has been taken at 90 lbs. in the examples given, but this value may be much reduced if water presses under the dam, and the reduction will be in proportion to the quantity of the bottom surface pressed upon, or exposed to the action of the water. As the construction of some forms of coffer-dams are more liable to admit water underneath than others, s may probably in such cases have to be reduced so low as 60 lbs.

The dimensions in the last example are nearly those of the coffer-dam used by *Semple* for constructing the piers of Essex Bridge, in Dublin, in 1753, the depth of water varying from 13 to 20 feet along the line of the coffer-dam. This coffer-dam deserves particular attention as being probably the first constructed in the kingdom, at that time, for such a depth of water; and from the difficulties the engineer had to encounter in the execution of the work, and overcoming one of the prejudices of the time then supported by the authority of a *Labylye.*

Figs. 7 and 8 show a plan and section of the coffer-dam taken from *Semple's Treatise of Building in Water,* which the author acknowledges to have taken from *Belidor's Hydraulic Architecture.* The piles are about 6 inches square, placed at 4 feet apart along the line of the dam, and sheeted along the inside with, apparently, inch boarding. B high-water mark, A low-water mark, D bed of river, C C occasional braces, f, g, and e, auxiliary braces, and P pudling. The width between the sheeting from out to out is 15 feet, and the main dam is 5 feet wide. This construction is however far inferior to that of continuous sheet piling as adopted at St. Katherine's Docks, and at the New Houses of Parliament; as the resistance, offered by the depth of bed penetrated by the pileing, is trifling in the former plan compared with that in the latter, but on the other hand the quantity of timber employed is less in the former.

Fig. 7.

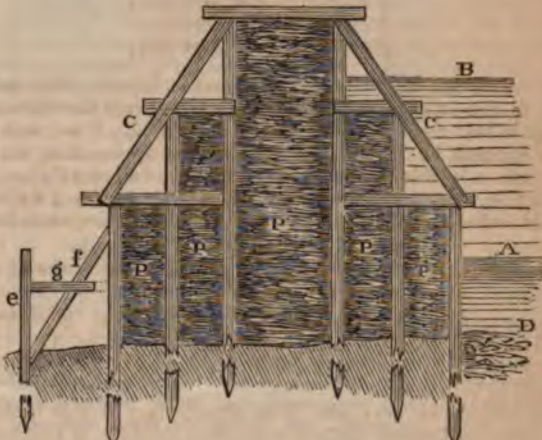
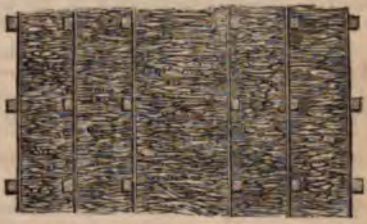


Fig. 8.



It may be necessary in conclusion, to remark that the depth of water ought to be taken from the surface to the bottom of the exposed coffer-dam, inside; for though that depth may not be on the outside, yet the water generally forces its way down so far; or if not, forces the bed with nearly an equivalent pressure against the coffer-dam.

Ancient Greek Manuscript.—An important discovery has been made by M. Didron, during his recent archæological tour in Greece and Turkey, of a Greek manuscript, about 900 years old, containing a complete code of religious monumental paintings. This document, found at Mount Athos, gives full instructions concerning all the subjects and persons that ought to be painted in churches, with the age, costume, and attributes that each figure ought to have. A copy of this manuscript is making at Mount Athos with the greatest care. Another manuscript, containing a similar code on religious architecture, is believed by M. Didron to exist at Adrianople, and he has some hopes of obtaining it.—*French paper.*

LONDON AND WESTMINSTER BANK.

WITH AN ENGRAVING, PLATE VIII.

THE accompanying engraving originally appeared in the *Atlas*, from which also we are enabled to give the following description of the building.

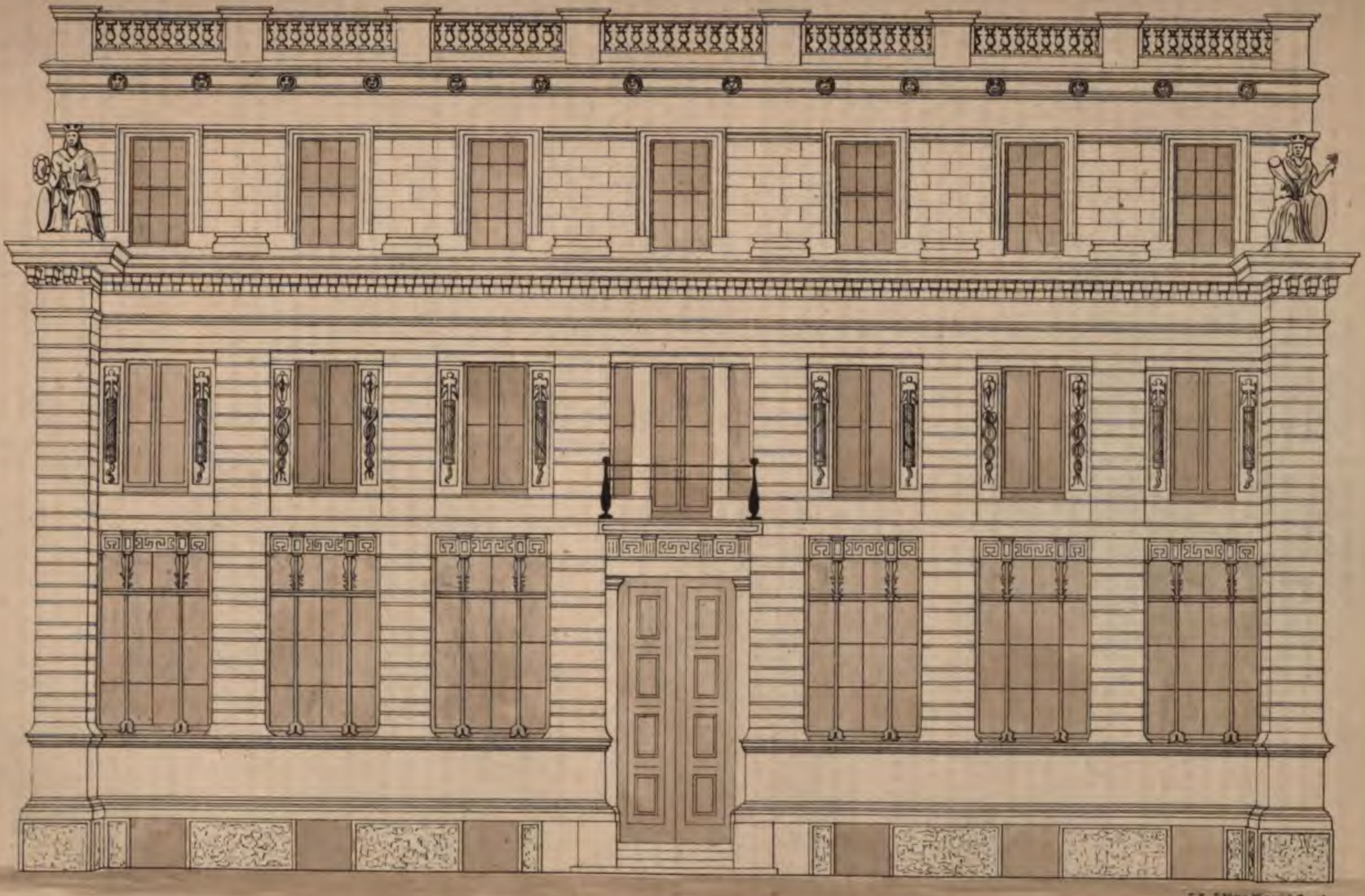
This new building for the city establishment of the London and Westminster Bank, which was completed in the latter part of 1838, under the joint professional superintendence of Mr. C. R. Cockerell and Mr. William Tite, architects, is situated in Lothbury, immediately opposite to the Bank of England. The whole structure occupies a site of nearly eighty feet in frontage, and ninety in depth. The entrance front possesses, not only from its extent, but from its architectural treatment, a bold and imposing character. It displays, indeed, no columnar decorations, no hundredth edition of an approved portico; but its composition has the much greater merit of strict appropriateness, simplicity in general forms; such simplicity, we mean, as conduces to unity, together with a perfect expression of purpose; an air of solidity and strength, and a judicious equality of decoration. The façade consists of one general plane or face, broke only by an advancing pier at each end. It has seven apertures in the length, and three tiers of them in the height; the two lower tiers, comprehending the openings on the ground and one-pair floors, are included in one architectural story, or order, if such it may be called; the upper tier, which consists of the windows of the two-pair floor, being contained in an attic story. The whole of the front is of Portland stone, with the exception of the plinth, which is from the Bramley-fall quarries. To describe the front rather more in detail, we may state that the substructure is a stylobate, or continuous pedestal, resting upon a deep rock-faced plinth. From this stylobate rise broad pilasters. or rusticated piers, in courses of alternate widths; the whole including, as we have said, two tiers of openings, and surmounted by a regular entablature, the cornice of which is enriched with modillions. Of the seven compartments into which the front is divided, the central one is somewhat wider than the rest, and displays, on the ground floor, a handsome entrance doorway of large proportions, and deeply recessed, approached by several steps externally, and having the flight continued within. The remaining intervals afford six large windows, each being so wide as to admit of subdivision by two mullions and a transum of cast iron, of elegant design and novel structure; the isolated mullion partaking of the character of an antique candelabrum at the base, and finishing with a scroll or console at the top: very wide and lofty Venetian windows are thus obtained, without affecting the real or the apparent solidity of the fabric, and the great and important problem (as applied to the City of London), namely, to obtain the largest possible admission of light, with the smallest obstruction of solids or piers, is most effectually, and, at the same time, architecturally attained. These windows are furnished with Bunnett and Corpe's iron shutters. The windows above, upon the one-pair story, are narrower than the former, and consequently leave, on each side between the rusticated piers, intervals available for decoration: these are sculptured alternately with caducei, the invariable commercial symbol, and with the bundle of sticks, expressive of the *vis unita fortior*, so appropriate to the union, or joint-stock association, of this establishment. In consequence of the advance of the two end piers in the principal order before-mentioned, there is gained in front of the attic story, which is not similarly broken, sufficient space for the display of two statues of seated female figures, emblematical of the commercial interests of London and Westminster, and having shields charged respectively with the arms of those cities; a mode of applying statuary to the purposes of external decoration, enlivening and appropriate to the general structure, and effective as regards the proper development of the subjects themselves. These figures are designed (and one of them—that of London—we understand to have been modelled) by Mr. Cockerell, and executed by Mr. Nicholl.

But it is time that we pass to the notice of the interior. The entrance vestibule or avenue has, on each side, a line of four plain Doric columns, with appropriate entablature and decorative mouldings. Its effect is, however, unavoidably impaired by the interference of two pairs of screen doors, though these are panelled and surrounded with plate glass, to obviate the objection as far as possible. From this ample vestibule, access is gained on the right to the country bank, the principal staircase, and some official apartments; and, directly in front, to the principal, or town bank. The latter apartment is not only by far the most considerable in the building, but is unequalled in importance by anything of the kind in London, except in the case of some offices of the Bank of England, and in altitude it exceeds even them. Its general form is a square of about 37 feet, whose height is that of the entire building—namely, 59 feet 6—and is extended by latera additions, east and west, to a portion of this height. These additions or aisles are divided from the centre, on each side, by an arcade of three arches, springing from Doric columns of the same size and order with those of the vestibule, with cornices. The columns themselves, in common with all the other features of the design, display a sober and subdued style of decoration or enrichment, being fluted only at the upper and lower extremities, and elevated upon plain flat plinths. The surrounding walls are channelled in rustic courses to the height of this order. The aisles or extensions are sufficiently lofty, by the arches raised upon the columns, to allow of the introduction of a gallery on each side, finished in front by a balustrade. Above this, the arches of the arcades run across over the aisles, and are intersected by a contrary vaulting, producing a system of groins as ceilings to the galleries; they are also advanced over the main body of the building, and treated as a series of half groins, so as to afford support to an upper projecting gallery, which passes quite round the principal square. The verge of this upper gallery is guarded by a simple, but handsome barrier, consisting of a double horizontal rail, sustained at intervals by ornaments of scroll foliage. Over this gallery the lines of the cubical form below are continued through, and gathered up, by means of pendentives, into a domed figure, exhibiting nearly that portion of a hemisphere cut off by planes raised upon the sides of a square inscribed within its circumference. The top of this dome is pierced by a large circular opening for a skylight, the margin of which is covered, and additionally ornamented with mouldings and lions' masks. Light is also obtained by triple windows, occupying the flat semicircular spaces left by the pendentives of the dome, on the three sides which are expesed to the view of a person entering, in the manner of the imperial Roman baths: these windows are filled with glass in geometrical compartments, alternately ground and polished. Smaller semicircular windows are introduced likewise in the three arches on the north side, which form a continuation to those of the lateral arcades, so that a very sufficient light has been contrived throughout this vast apartment, surrounded as it is with lofty and close buildings on all sides. Such is a general description of this apartment, the composition of which displays considerable novelty of adaptation, magnitude of proportions, and felicity of effect. The general forms are very happily diversified, and the decorative details distributed with equality; except, indeed, that the eye would have welcomed the application of some enrichment to the large expanse of the dome, which is left entirely plain. The fittings up are in a style of appropriate completeness; comprising handsomely finished and extensive ranges of counters; a massive central stove, of consistent design, being a bee-hive, round which the arms of London and Westminster, and the guardian of British commerce, as well as of goverment—the lion—are ranged with taste and propriety; an hydraulic apparatus, by which plate chests and cash boxes may be lowered into the basement story for security, or brought up with great facility, and other minor appurtenances.

RAMBLES BY PHILOMUSÆUS.—No. V.

THE BRITISH MUSEUM.

AFTER this establishment has been partially closed for months, its directors have felt themselves compelled to show the public that at least they have not run away with the collections. They still keep the long gallery closed, and have thrown open two new galleries, in which a few unnamed articles are placed in undescribable confusion. We have seen representations of the plunder of a wreck by a crowd of savages, one with a pair of breeches in his arms, another with a coat matted round his waist, running from one package to another, ransacking their contents, and then throwing them about in confusion, and such is the state of the Museum. Egyptian coffins in one place, Etruscan tombs in another, all in most admirable disorder, the passages choked up, the rooms encumbered, and packages covered with the dust of months, accusing the inefficiency of the officers of the establishment. Nothing, perhaps, more nearly resembles the Spectator's description of a monkey in an Egyptian temple, ranging about not knowing what to do, and then establishing himself in a corner. That this institution has the active services of many men of the highest ability we fully recognize; we do not complain that there are not enough men of talent, we only call for the employment of more routine-working men. We are sure there are numbers of young men, sufficiently qualified, who, for a small remuneration, and many indeed for none at all, who would, under the superintendence of the officers, be competent to assist in the classification, without requiring a permanent employment in the establishment. We know that there is a great want of room, that the architectural department is sadly cramped,



J. R. Jobbins, Warwick Court.

THE LONDON & WESTMINSTER BANK.

but we are convinced, notwithstanding, that there is a want of energy on the part of the officers, which throws the business into arrear, and paralyses the whole operations.

The Long Gallery has now been closed nearly a year, and the public thus shut out from the Portrait Gallery, the geological and mineralogical collections. At the same time we know that Dr. Mantell's collection of nearly thirty thousand specimens has been purchased, and ought long since to have been arranged. The Etruscan collection has remained in its present state during the whole of the last year, and thus has it been rendered totally useless. The Egyptian collection is, on the lowest estimate, two years in arrear, and the Vase Room good for nothing. As to the mammalia, their condition has been a subject of ridicule many years, and every month, by increasing the collection, renders the absurdity but more manifest. The managers of this department certainly deserve the highest praise for their compressive power, in which, doubtless, they have hardly yet met with a rival. An old bachelor's travelling portmanteau is nothing to it; cats crouching under lions, deer striding over wolves, the cases, crammed even into the crevices with stuffed animals, show a crowd of imprisoned and confused creatures, which even the ark of Noah could not equal.

With regard to what has been done, it has been little indeed. The arrangement of the Ægina marbles has been completed, the Phidian and Phigalian Saloons have been painted of a red granite colour, which, it is to be wished, may be continued throughout the whole house. The collection of fish, saurians, and batrachians, has been extended, and the insects and corallines removed. At Paris, a much greater number of entomological specimens is exhibited to the public, and so far is the respect even for vulgar curiosity carried, that the whole of the papilionaceous tribes are shown, forming a sight of natural beauty which is well calculated to strike the spectator with emotion. It is a national disgrace, that, ruling over one hundred and forty millions in India, we have no good collection of oriental objects, the illustration of our own antiquities is equally defective, and many departments flourishing in countries of less resources, are here totally neglected.

As to the catalogues of public collections in this country, with the exception of a portion of that of the British Museum relating to natural history, they are miserably defective, and inferior to what is done abroad. The catalogue of the National Gallery is a gross imposition, charging one shilling for a book which contains about one pennyworth of print and paper, and scarcely one farthing's worth of information. The catalogue of the Louvre, although necessarily restricted, gives much more detail, the name of the painter, of his master, the period at which he lived, the school to which he belonged, and a description of the subject. That of the National Gallery gives the name of the painter, and the date of his birth, and only the name of the picture, giving such references to the people as to a story in Tasso, and limiting the descriptive matter to a history of the picture, which, as many of the works are spurious or contemptible, is of no value. The catalogue of the antiquities in the British Museum is of no use, either to the artist or the public, giving the name of the statue, and barely that! No—a Mithraic subject! Who knows what that means, or who can tell where to find out. The catalogue of the Paris Museum of Antiquities, under the same circumstances, gives a page or two of small type to an account of the Mithraic rites. That catalogue gives, in every case, the name of the subject, extent of mutilations or restorations, history, stone of which made, height and breadth, and a full antiquarian and artistical account, with reference to the authorities of any peculiarity to be observed in the statue. To such an extent is this carried, that the catalogue is a complete encyclopædia of Greek and Roman costume, having the author's name attached to it, and invaluable to the student.

THE PUBLIC WALKS OF LONDON.

Much is said about the public gardens and walks of Paris, nothing is said of those of London, except by foreigners whom they never fail to strike with admiration. The Tuileries, the Champs Elysées, the Luxemburg, the Jardin des Plantes, and the Quais have great and incontestable merits, they possess features which we cannot rival, but those of London again are unexcelled in their own department. Each style is suited to its respective nation, perhaps it is a consequence of their several characters, perhaps a cause. We see at once the Frenchman in the classic statues, in the ordonnanced foliage, the imprisoned orange trees, and the straight walks. The Englishman seems to impress his own character in the grassy slopes, luxuriant timber, and placid waters of the scenes in which he epitomizes his beloved isle. The Frenchman knows no paradise without artifice, the Englishman none without nature, the American hates even the sight of a tree. That of which we have to complain is neither the grandeur nor extent of our public walks, but their unequal distribution. The parks were truly named the lungs of the metropolis, they are so, to the overworked mechanic they are receivers from which he obtains fresh breath to carry on his life-shortening labours. Yet as in the human being if we had an unequal distribution of the respiratory organs, we should find an atrophy of the body, so in the immense metropolis an insufficient provision of these necessaries of life causes an immense loss of human existence. The southern portions of the metropolis between Greenwich and Kew are miserably unprovided, but it is among the impoverished population of the east that the want is felt in all its severity. So great indeed is the difference between the average value of life in the east and the west of the metropolis, that whereas in the latter it is 2·1 per cent., in the former it is 3·2, and in Whitechapel it is so low that one female in twenty-four dies in a year, an awful mortality, scarcely perhaps equalled by Portugal or any other misgoverned country.

The walks of London may be divided into two classes, public and corporate, and the former again into special promenades and into thoroughfares and micellaneous sites used for this purpose.

Among the special promenades are to be reckoned St. James's Park, collection of curious birds, military monuments and music; Green Park; Hyde Park, military exercises and Kensington Gardens, military music; Regent's Park; Greenwich Park; Kew Gardens; Draper's Gardens, Throgmorton-street; Artillery Ground, City Road, military music; Tower Hill, recently planted; Lambeth Walk; Cheyne Walk, &c.

Among the other places used for walks are the old commons and greens as Islington and Kennington; Chelsea Hospital; the Cemeteries at Kensall Green, Highgate and Norwood; the Docks, &c.

We have not a line of Quais as at Paris, and we should be sorry indeed if we had, but we have points on the river affording unrivalled views:—the Dock Wharfs, Tower Wharf, Custom-house Wharf, Temple Gardens, Waterloo Bridge, the Adelphi Terrace, Hungerford Stairs, Millbank, Cheyne Walk, the Bishop's Walk (Lambeth), and the Terrace of Greenwich Palace.

Coming to the second class walks belonging to and used by communities, we have the unrivalled squares, the gardens of Lincoln's Inn, Gray's Inn, the Temple, Charterhouse, &c.

These many establishments place London almost without a rival in the provision for this department of public health, and in the beauty of many of the establishments and their accessaries, as well as in the splendour of the views which they afford,—unique prospects of one of the largest cities and ports in the world.

GOVERNMENT MEASURES FOR STEAM VESSELS.

It was with regret that we learned that on the first day of the session the government gave notice of their intention to bring in a bill for carrying out the recommendations of the Steam Vessel Inquiry Commission. This report has now been long published, and so far from attracting the support of those who have examined it, it has excited either open hostility or silent contempt. We had occasion on its appearance to call the attention of our readers to its provisions, we pointed out the meanness and paltriness of the means by which it was attempted to be supported, and the injurious results which must infallibly ensue from the enactment of its provisions. A case of grosser jobbery, or more iniquitous misrepresentation than is presented by the report was never hardly brought before the public. Had indeed the necessity of inquiry been so great as to require investigation only to ascertain the extent of injury, a case would at once exist for the appointment of a commission, but when no such necessity existed, when no evils prominently called for redress, it was but a gross mockery of public credulity, and an arbitrary exercise of delegated power to invest men of whatever standing with authority, which they received as it were with permission to direct for their own personal advantage. What was it but calling on the commissioners to make out a case not only to justify their present employment, but to give them occupation for the future, to do as they have done in this case, to use every artifice of an accuser to overwhelm the object of pursuit? Has even common respect been paid to the judgment of the public, common justice been shown to the victims of this persecution? facts of trivial insignificance have been overrated and overstated, a judicial investigation has resorted to absurdities to bolster up a false cause, popular prejudices have been appealed to, insufficient and untried examples have been enforced as of authority and example, in fine the dignity of the government and the people has been outraged, the prosperity of the country threatened, and the vested interests of property attacked. And for what purposes but the grossest? To furnish new places at the expense of the best interests of the country, to subject the genius of its inventors and the characters of its manufacturers to an inspection more servile than degrades even a French police; to stifle ingenuity, to give a monopoly to ignorance and indolence, to cripple the energies of the nation, and in striking at one branch, to prepare a chain for all.

We have on previous occasions exposed the misrepresentations and fallacies of this report with an unsparing hand, and therefore refrain from enforcing on our readers arguments, of the truth of which they are well persuaded. We may observe that admitting all the statements of the commissioners to their fullest extent, they are but arguing from the abuse against the use, they are seeking to upset the great principles of English administrations, and to foist in foreign degradations; they are endeavouring to substitute for the grand principle of protecting the mass against the errors of a few, that of sacrificing the whole body to correct trifling abuses, a system which while it is being abandoned abroad, is endeavoured for the first time to be introduced here. Founding their claims upon untried or inefficient precedents, they call for powers greater than even these examples authorize, and make up by boldness of demand for the weakness of their cause. They rely upon the examples of the United States and of France, they dare to bring forward that of Belgium, they conceal that other circumstances prevail in the States, that the laws of France are inefficient and unobserved, and that Belgium has no vessels for which to legislate.

This measure ought not to be, cannot be, carried; its results are too evidently mischievous to allow us to believe that the parties affected can be so deaf to their own welfare as to allow it to be carried into effect without resistance. We call upon them, therefore, to unite, to meet together and concert measures for the defeat of a project so odious and so ruinous; it is only by union that this can be effected; it is thus the aggressions of government have been successfully resisted by the railways and other interests. We earnestly advise, therefore, that immediate steps should be taken for calling a meeting of the boat-builders, engine-makers, and steam-boat captains, and of all those who have property embarked in this large and increasing branch of the shipping interests.

THE STATUE OF HUSKISSON.

By John Gibson, R. A.

[We are indebted for this able paper to the kindness of our eminent and talented correspondent at Rome, whose love of art is only equalled by his knowledge of it.—Editor.]

We have much pleasure in announcing that Mr. Gibson is engaged in executing another statue of Huskisson, which, we understand, is to be placed in the Custom-house, at Liverpool. This statue differs in some respects from the former one executed some time ago, in as much as that, the attitude is different, and we think that it is more dignified, and seems to breathe the true Attic spirit of a great orator, both statues however partake of the character of the Demosthenes of the Vatican, and the Aristides[*] of Naples. The latter was so famous that Demosthenes accused his rival Eschines of imitating it, or an antique statue that resembled the Aristides, by folding his arm in his pallium when he addressed the public from the rostrum.

As the former statue of Huskisson was sacrificed from the fact of its having been placed in a temple of too small dimensions, we therefore shall offer a few observations, lest the one we now are about to describe should share the same fate. The first statue was composed in such a manner as to allow of its being seen in any point of view, and it necessarily followed, that the temple should have been of that magnitude, to have enabled a spectator to have encompassed with his eye the entire figure on walking at a sufficient distance around it, whereas it was found necessary to place it with its back to the wall. Thus it is that the skill of the sculptor displayed in the composition has been miserably defeated by the ignorance of the architect; in consequence of which the statue can only be seen in one point of view, and that, the most unfavourable, remaining enshrined in stone, hid from vulgar eyes, like the oracle of Delphi. The height of the statue should have given the architect the scale of proportions for his temple. Arrian's description of the Pontus Eurinus, says that the statues and images placed in a sacred edifice should always be in proportion to it, as being a part of it. "Quod enim ad membra sacrarum ædium etiam statuæ earum atque imagines pertineant, docet nos Arrianus in ipso statim invitio peripli ponti Euxini." The proportions of temples with regard to the statues which were to be placed in them was strictly observed by the ancients. The Emperor Adrian objects to the statues of Mercury and Philesius in the temple of Trapesuntia, as being less than the just proportions which the temple required. "Ibi enim Adrianum Imper: certiorem facit Mercurii ac Philesii statuas in Trapesuntiorum templo minores esse, quam pro ipsius templi ratis debeant." Bad artists place small statues upon large pedestals, thus showing their own ignorance. Vitruvius says[*] all the parts of a sacred edifice must agree in each single part with the general height of the whole.

Trusting this second statue will not share the same fate, we will now proceed to describe it. The statue, like the first one, is colossal, Huskisson is represented standing in an easy and dignified attitude. the right leg a little advanced, his arms are naked, and the left one is raised towards his face, whilst the right arm hangs by his side, and in the hand he holds a scroll. The breast is naked, while the drapery falls within a short distance of his feet, and is brought over the left shoulder. The attitude is becoming the senatorial dignity of a great statesman, and is at once quiet and impressive; from the stern and meditative air it might be almost imagined that he was about to summon up to his bidding all the resources of his gigantic mind, and that he had grown a colossus in power,—that Demosthenic eloquence was about to burst from his lips. The head which we believe is a faithful portrait, has all the artistical attributes which are indicative of genius, approaching to the beau ideal of a philosopher, the expression of the face is severe, and the features are vigorously pronounced, the cold marble is made to breathe with a soul, nay almost with human intelligence. The nude is true to nature, yet all traces of mechanical art and vulgar impurities have been effaced by the magic touches of a chisel directed by the master hand of another Phidias, it has made the marble start into immortal life. The entire figure would seem to have been cast in that mould in which the Greeks were wont to form their heroes and their gods. The drapery is consonant with the subject, masterlike in style, easy and flowing, it is in fact the Greek pallium, consequently classic, and hence suitable to assist at the apotheosis of a great statesman. Huskisson like another Aristides,[†] has now had a statue raised to his memory for having caused by his eloquence the embellishment of that city which gave him political fame during life, and immortality after death. He is fortunate too in having for his artist a fellow-citizen so distinguished. In the drapery of Gibson's figure we find that it is disposed with judgment, while the skill shown in the arrangement of the folds gives a rich effect, and the harmony of the lines serve to preserve a proper balance of light and shade. We also remark that the angular creases, and the spirited touches of the details contribute to the grand effect of the whole. To arrange drapery is one of the most difficult branches of the art, sculpture cannot as in a painting, imitate the nature of the stuff, and give the various shades of colour which have their origin from the reflection of light and shade.

Quatremere de Quincy observes, "that ancient clothing is employed by art, not as ancient but as natural, not because it was adopted by the Greeks and Romans, but because no other can be employed in imitation; and further not even so much because it is accordant with the metaphorical style, as because the modern costume is anti-imitative. This being the case, the interest of every nation requires that in confiding to the sculptor the task of perpetuating its exploits, and its great men, it should watch over the taste and the style of imitation in works, which while they inspire respect for the images so enshrined, may bear favourable testimony to future ages of the period at which they were upraised."

No reasoning can be stronger than this, and we think the observations of the above cited learned author irrefutable, but we will repeat that the modern style of dress is wholly inconsistent, and quite unworthy of the dignity of sculpture, and we shall find that whenever it has been attempted, whatsoever might have been the style of dress of the period, classic taste has been ontraged and every principle violated which is the characteristic of beauty in art. The object of sculpture is not to give an individual portrait dressed up in the whimsical or the ephemeral fashion of a day, but to perpetuate the memory of persons by investing the lasting marble with the attributes of that classic style of art, which has been handed down to us by those whose works yet stand omnipotent, and have outlived the wreck of time. Sculptural portraiture in fine was considered by the Greeks and Romans as a convention, at once allegorical and imaginary, sometimes it represented the metamorphosis of the gods, or the apotheoses of princes, warriors, orators, poets, and philosophers. The statues of

---

[*] From some very recent discoveries we believe that this statue called Aristides, is Eschines himself,

[*] Vitruvius, lib. 3, cap. 5.

[†] When Smyrna was destroyed by an earthquake, Aristides wrote a letter so pathetic to M. Aurelius that he ordered the city to be immediately rebuilt, for which intercession a statue was in consequence raised to the orator,

Alexander, Adrian and Antinous are naked, and were made ideal gods, they like the statue of Pompey, seem to have a mystic life, there is a very language in those cold, stern, and colourless stones, which breathes an air of truth and creates on our minds more interest than their names in the pages of history. The statue of Napoleon,* by Canova, is naked, and is an apotheosis; it is confessedly, grand, imperial, and collossal; it has immortalized the hero, as well as the artist, and when we consider that Canova and Gibson were the first to set so good an example to their country, we must say that their statues will ever stand pre-eminent over the barbarous objects which disfigure some of our public monuments.

We would ask is there a person capable of reflecting who has paced the vast sculpture gallery at Versailles, and not smiled at the absurd dresses of some of the marble effigies; in days gone by they were admired, and the persons they represented were doubtless, much venerated, but alas! how changed, they now excite our contempt, and we feel inclined to laugh outright at their antiquated costumes. The time will come, and it is not far distant, when the vagaries of our sculptors will share the same fate, and become also objects of ridicule. It is an opinion held by some artists that all monuments should have the figures executed in the style of dress of the period in which they were erected, but we feel sorry to observe that it is only interested and inferior artists who advocate this opinion, and it is because they find that to model drapery and the naked proportions is excessively difficult, and often beyond their capacity, they are therefore contented to please the ignorant multitude, who for the most part, like the cobbler could only criticise the sole of the shoe in the picture of Apelles, for which reason persist in perpetuating the fame of our generals and admirals in all the glorious absurdity of modern tailory—epaulets and cocked hats, boots and spurs. Of what possible consequence can it be to us that antiquarians should discover in after times that pig-tails were commonly worn in the reign of George the Third? and moreover, that it was a most singular custom with their ancestors to represent great warriors in a mutilated state, having only one arm, and sometimes wooden legs. This they would conjecture was done to bring to the recollection of the public that they had lost their limbs in the service of their country. Lest the time may arrive when even the name of a Nelson should be blotted out of the page of history, we would recommend that his amputated arm be placed by his side, to convince future ages that he was once a perfect being, and furthermore to satisfy the public who ever crave after monstrosities,† the arms and legs of his brave comrades might be piled up in a group as monumental trophies of their valour! Non eadem miramur!!

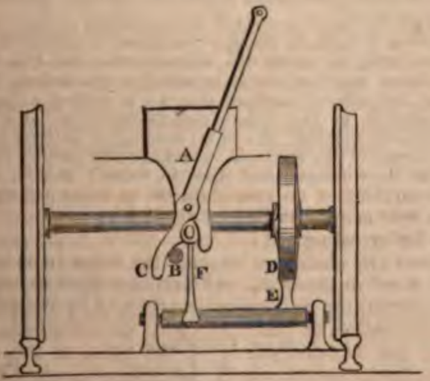
FELAGRIO.

Rome, January 18, 1840.

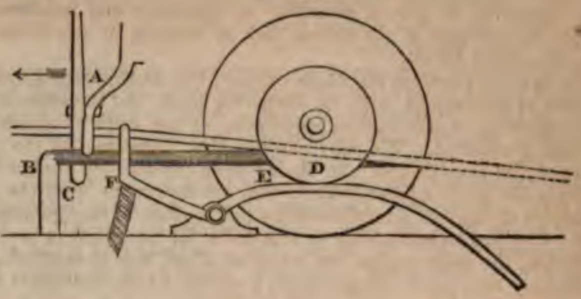
DIOGENES'S SELF-ACTING GROUND-ROPE APPARATUS,

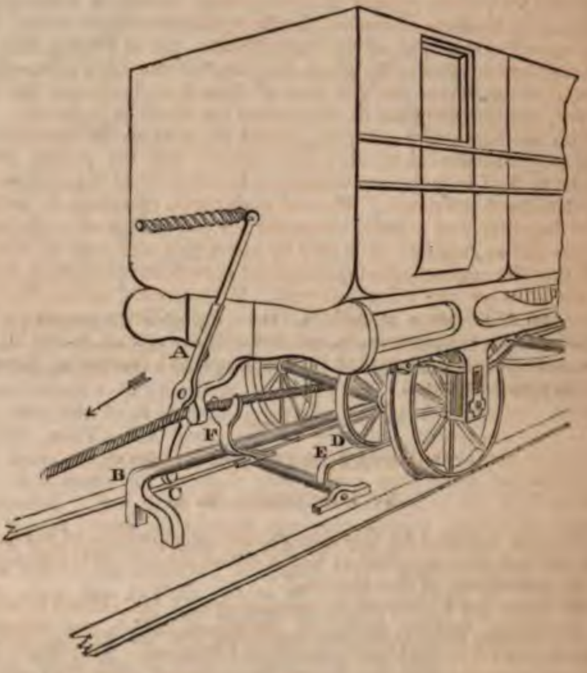
FOR TAKING UP THE ROPE.

Front View.



Side View.





REFERENCE TO THE LETTERS.

A	Claws or holder for the rope.
B	Bar for forcing open the claws, in order to liberate the rope, or previous to taking hold of it.
C	Lower part of claws, which works against the bar B.
D	Small wheel fixed upon fore axle of carriage to elevate the fork.
E	Lever over which the wheel D passes, and forces it down.
F	Fork fixed on the same axle as the lever just mentioned; but by being on the opposite side, it is raised as the lever is depressed; it is pulled down again by a spring It is to raise the rope to the level of the claws; were the claws fixed lower, they would catch against the pullies. It should be observed that the fork is not raised until the claws have passed it. The rope is liberated by a similar bar, only the fork for lifting up the rope is omitted.

THE EPICYCLOIDAL STEAM ENGINE.

[We have given this communication at the request of some of our readers, although it is not new, as we stated in our notice to correspondents. The motion will be found described in the second volume of Gregory's Mechanics, and the author there states that it was introduced in an engine erected at Bermondsey. It may be seen as we before stated at the Saw Mills in the Arsenal at Woolwich.]—ED.

SIR—I am happy to communicate my improvement on the steam engine.

In all engines now employed the motion of the piston rod is communicated by a connecting rod to the crank. This rod, by the nature of the motion always works obliquely. The obliquity of action is certainly objectionable, as it evidently occasions a loss of power.

---

* This fine statue of Napoleon is in the possession of his Grace the Duke of Wellington, at Apsley-house.—ED.

† We have *dogmatical* proofs that the French have outgeneralled us in sculptural atrocities, for in the triumphal arch of Napoleon at Marseilles, there are *poodle-dogs*, and a whole legion of amputated *arms and legs*.

Accordingly, the connecting rod is always made as long as may be, within limits fixed by other circumstances, for thereby the obliquity of its action is diminished. A method of communicating the motion of the piston to the crank, without loss of power by such a cause, has therefore been a *desideratum*.

The fundamental principle of my contrivance is, that the epicycloid generated by any point of the circumference of a circle rolling on the interior of the circumference of another circle of twice its diameter, is a straight line, the same point always describing the same straight line. Thus, the circle A B F, fig. 1, rolling on the circle A C A′, in the above-mentioned circumstances, any point, A in it, moves up and down A A′, a diameter of the larger circle, It is easily inferred too, that the centre E, of the inner circle describes a circle E G, of equal radius concentric with the larger circle; so that, were E and F connected, the connection E F would move round F, in the manner of a crank.

Fig. 1.

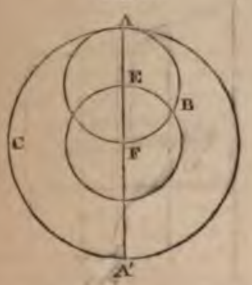
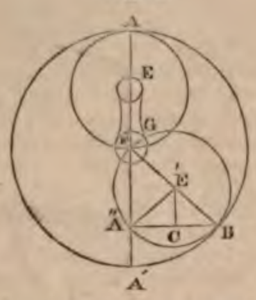


Fig. 2.



Now, let A A′ and A F, fig. 2, be the primitive diameters of two teethed wheels, in which the teeth of the larger one on the interior of the circumference, and those of the smaller on its exterior, so that they may run into each other. Let G be the extremity of a shaft concentric with the wheel A A′, and carrying a crank G E, of which the pin at E is also concentric with the smaller wheel A F. Then, when G revolves, it carries the wheel A F with it, which runs on the crank pin, its teeth at the same time taking into those of the wheel A A′, and the point A of the wheel A F describing the path A A′. Reversing the mode of action, suppose the large wheel to be fixed; then if the piston rod of a steam cylinder of which the stroke is equal to A A′, be jointed to a pin standing on the primitive circumference of A F at A, for example, the machine, with a fly on the shaft G, will work, so as that this shaft will have a continous rotatory motion.

In this method there is neither connecting rod nor parallel motion. The piston rod is connected immediately with the pin on the wheel A F, and is led up and down rectilineally by the very nature of the motions.

Now, the fact that no special parallel motion is required, proves that none of the power is wastefully exerted. To be more minute, however, suppose the crank in the position F E′, fig. 2, A′ A″ will be the piston rod, jointed at A″ to the wheel. Producing F E to B, this will be the touching point of the two circles. Draw A″ B, A″ E′, and drop the perpendicular E′ C upon A″ B. Then A″ E′ B must be considered as a crooked lever of the second kind, in which B is the fulcrum, and E′ and A″ respectively, the points of application of the resistance and power. Now, in the triangles F E′ A″, A″ E′ B, the angle E′ F A″+E′ A″ F (or 2 E′ A″ F, 5.1. Euclid)=2 right angles—F E′ A″; and E′ A″ B + E′ B A″ (or 2 E′ A″ B, 5.1. Euclid)=2 right angles—A″ E′ B (32. 1. Euclid). And taking the half sum of these equations, we have E A F+E A B=2 right angles—(F E′ A″+A″ E″ B) =1 right angle, that is, A″ B is perpendicular to A′ A″, and therefore, A″ B is the leverage of the power acing in the line A′ A″. C B is also the leverage of the resistance acting in the line E′ C; and it is easily seen that A B=2 C B; so that, as this demonstration applies in every position of the crank, putting the angle A″ F B′=Z, and F B=1, we conclude, in general, that,

1. The leverage of the power $=\sin. Z$;

2. resistance $=\frac{\sin. Z}{2}$;

3. The line of action on the crank is always parallel to the piston rod. Now, as could easily be proved, by this mode of action, namely, the parallelism of the impulse on the crank, the whole power of the piston is communicated to the main shaft; and thus is my object proved to be attained.

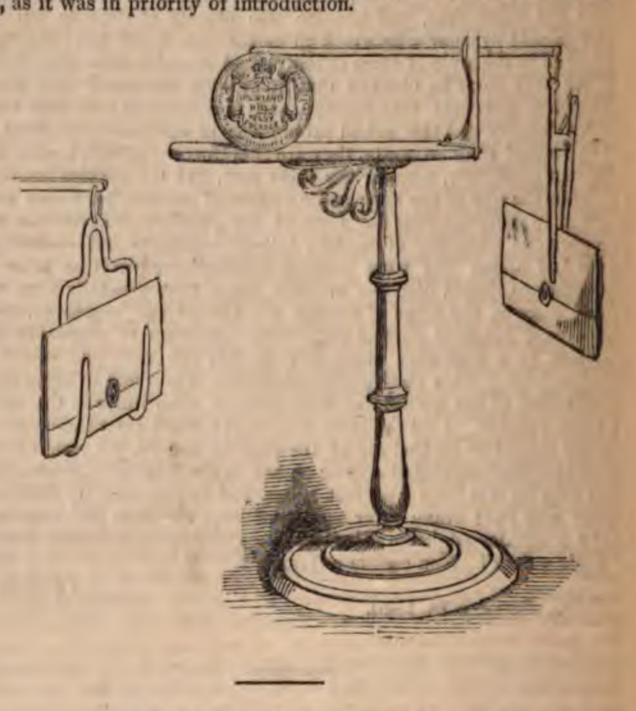
Besides the advantage already stated, this engine possesses two others, simplicity of construction, and smallness of bulk. It differs from the common ones in this also, that with the same sweep of crank, it has twice the length of stroke; and accordingly, as we see from the above two fixed conclusions, the leverage of the power is twice that of the resistance.

I am, Sir, your obliged servant,
DANIEL CLARK.

Glasgow, Dec. 19, 1839.

HOOPER'S POST OFFICE LETTER WEIGHTS.

THE accompanying engraving represents one of Hooper's peculiar letter balances, the merits of which are its simplicity and accuracy; a grain in effect would turn the balance either way. Although numerous devices have been intrduced for this purpose, none that we have seen surpass this in utility, in which it is as much before its competitors, as it was in priority of introduction.



THE FITZWILLIAM MUSEUM.

THE Fitzwilliam Syndicate have reported to the Senate:

"That Mr. Basevi has certified to the Vice-Chancellor that Mr. Baker has executed works in the building of the Fitzwilliam Museum to the value of £34,000 or thereabouts; and Mr. Basevi has thereupon recommended that a sum of £5,000 be now paid to Mr. Baker on account of the said works in addition to the sum of £25,500 already paid to him on that account.

"That although the above-mentioned sum of £5,000 exceeds the instalment which Mr. Baker is at present entitled to demand according to the terms of the contract; the Syndics, under the circumstances stated in *Mr. Basevi's certificate and letter, beg leave to recommend to the Senate that the said sum be paid to Mr. Baker, provided that he is willing to agree that the balance to be retained by the Vice-Chancellor until six months after Mr. Basevi shall have duly certified the entire completion of the works, shall according to the terms of the contract, be not less than 10 per cent. upon the whole amount of the contract; and that Mr. Baker's sureties are willing to agree that the payment of the sum of £5,000, as above proposed, shall not affect or impair their present liability under the contract."

The Syndics further recommend;

"That Mr. Basevi be authorized to order the execution at a cost not exceeding £1,000, of certain works at the Fitzwilliam Museum not included in Mr. Baker's contract; it being advisable that such works should be completed previously to making any further contracts for the finishing of the building.

R. TATHAM, *Vice-Chancellor*.
W. FRENCH. G. PEACOCK.
G. AINSLIE. J. HAVILAND.
J. GRAHAM. H. PHILPOTT."

At the Congregation this day, a Grace will be offered to the Senate to confirm the above Report.

---

* Mr. Basevi's certificate and letter will be laid on the Registrar's table.—*Cambridge Advertiser*.

EXPLANATION OF SOME TECHNICAL TERMS USED IN STEAM ENGINE CALCULATIONS,

WITH REMARKS ON THE CORNISH QUESTION.

SIR—The full and satisfactory account you have given in your February number, of the new engine at the East London Water-works, must not only be highly interesting to those of your readers who are attached to pursuits connected with the steam-engine, but also to those who value truth for its own sake, inasmuch as it will very soon settle the long-disputed Cornish question, besides being of the greatest practical importance to the proprietor of mines and other large works in all parts of the kingdom.

It now appears that in my comparison of the Cornish and Lancashire systems in your number for January, I had, as indeed I wished to do, rather over than under-rated the power of the engine above referred to, and when I have all the data for going into the commercial part of the question—the comparative expense—I am afraid it will be found that the advantage of the Cornish system has been somewhat more largely overrated by others, especially with reference to the propriety of adopting that system in cotton factories. At any rate, when the proper corrections are made in my table of comparative duty, from the statement you have furnished, I think no one will be found to contend that *four, five*, and even *six* times more work (as has been often asserted) is performed by the steam-engines in Cornwall than in the north of England for the same quantity of fuel of like quality. Indeed, the excessive degree of perfection hitherto claimed for the Cornish engine is much to be regretted, even if true, as it carries a certain degree of absurdity on the face of it, that has not a little indisposed engineers on both sides of the question to a fair and dispassionate inquiry. With a view to expedite the settlement of the most important parts of the question, and prevent that divergence from the main point at issue which is liable to occur with the best-intentioned disputants, I have made the following attempt to define certain technical terms which prevail in this district, and it will be of use, perhaps, to some engineers both in and out of Cornwall. I am also induced to submit these definitions to the approval of your readers, because I observe, in Mr. Enys' remarks in your last number, a few slight misconceptions of my meaning, which, together with perhaps a want of strict accuracy of application in some of the expressions used by me, have led that gentleman to underrate the comparative duty of the Lancashire engine; there are also errors in his statement that go to the disparagement of the *Cornish* system, which I am sure must be quite obvious to that gentleman, as well as the rest of your readers, on the slightest reconsideration of the subject—I more particularly allude to the concluding portion of Mr. Enys' communication. No guess work allowances are at all requisite either for "vacuum imperfections" or engine friction and resistance in my estimate of the Lancashire engine, as the load on the piston of 10 lbs. per circular inch was not the calculated, but the *observed*, steam pressure taken by the indicator, as I distinctly stated, and it of course includes the friction of the engine, shafting, &c. The average steam pressure acting on the piston of the pumping-engine, was, on the other hand, not observed, but *calculated* to be 10·65 lbs. per circular inch, which would be the difference of pressure between one side of the piston and the other, due to the given load on the other end of the beam, including of course a small allowance for the friction of the engine itself, as was required to render it equivalent to the indicator pressure; but no allowance was required in this case, any more than in the other, for "vacuum imperfections." I purposely chose this method of avoiding the risk of making erroneous deductions from what I think is properly termed the "gross horse power," so that a more just comparison of the two systems might be obtained. Possibly some allowance may be required for pit-work friction, but as Mr. Enys seems to think that nearly equivalent to deficient water delivery, the omission cannot make much difference.

From the corrected data now given by Mr. Wicksteed, it appears that the load in the shaft, 66,443 lbs. must be reduced for the leverage of the beam in the proportion of 10 ft. 3 in. to 9 ft., or to 58,398 lbs. and this sum, *plus* an allowance for friction, is the gross load in the cylinder, instead of 68,160 lbs., which I had before assumed from the data then furnished to me. The proper substitutions corresponding to this correction being made in my table of "Comparative Duty," it will be seen that the latter will be materially altered in favour of the Lancashire system.

For the purpose already stated, and also in order that a clear understanding of the meaning intended to be conveyed in future, when comparing the power or economy of steam engines, it seems necessary that some technical terms commonly used by engineers and others should be strictly defined. The following are definitions of such as are used in reference to the power of the factory or cotton mill engine; and I trust that some of our Cornish friends will favour us with a similar elucidation of the equivalent terms that obtain in Cornwall, such as "duty, efficiency, &c."

The "*nominal power*" is what an engine is called by its maker, and Mr. Watt's standard, it is well known, was that due to an effective pressure of steam in the cylinder of 6 lbs. per circular inch, and a speed of 220 ft. a minute for each horse power. The "*gross power*" is the total power exerted by the steam in the cylinder, including that required to work the engine itself, or to overcome what are called the friction and resistances of the engine, and is equivalent to the whole force of the steam acting on the piston against a vacuum more or less perfect; or, in other words, it is the force resulting from the average difference of pressure between one side of the piston and the other; this average is that obtained by the indicator, and it is in general sufficiently correct for all practical purposes. The indicator pressure, it will be observed requires no correction or allowance for what are called vacuum imperfections, such allowance only being required when, for want of indicator experiments, the steam pressure in the cylinder can only be estimated from that in the boiler. The "*effective power*" is the total power exerted by the engine, or delivered at the crank shaft, after overcoming its own friction. This friction, of course, not only includes the friction, properly so called, of the piston, pump buckets, stuffing boxes, &c., as well as all the bearing parts of the engine, but it also includes the resistances due to the water lifted by the engine pumps, and is a quantity that varies in different engines according to the different degrees of excellence in their workmanship, situation, and other circumstances. In general it is found to be equal to from one to two pounds per circular inch on the area of the piston in the best modern engines, but in a much less ratio in large engines than small ones. When an engine can be unconnected with the shafting, its own friction can be readily ascertained by the indicator; this, however, would only be what M. Pambour properly calls the "*unloaded* friction," for, of course, the friction of nearly all the bearing parts of the engine must increase with the load in some ratio corresponding to the goodness of workmanship. This *loaded* friction is variously estimated by different engineers, at from one fifth to three tenths of the gross load; and Tredgold estimates it at about ·238 of the whole of the force of the steam in the boiler, or with the resistance to the steam in the passages, the loss of power by cooling, &c., included, he calls it ·368 of that force (see Tredgold, new edition, page 196). Although the unloaded friction of the engine, when the speed of the latter admits of being easily regulated, is capable of correct ascertainment, as I have already stated, yet it is rarely so obtained in factory engines separately from the friction of the shafting; but when so obtained and deducted from the gross power, the result gives a certain amount larger than the real effective power, by so much as the loaded exceeds the unloaded friction of the engine. This result has been proposed to be termed the "effective *indicated* power."

The "*net effective power*," or available power of an engine, is usually understood to be the power delivered at the machine pulleys, or that which is effective or available in turning the machinery, exclusive of that required to turn the shafting, the straps, and the loose pulleys. The friction of the shafting, when ascertained by the indicator, (the machine straps being thrown on the loose pulleys) is of course the unloaded friction, and as in the case of the unloaded engine friction when deducted from the effective power, leaves a result for net effective power somewhat greater than the truth; this result, however, has been proposed to be denominated the "net effective *indicated* power." This last is what is meant when the number of horses power required to turn any given portion of machinery is said to be ascertained by the indicator. It is always understood to include so much of the friction of the engine and shafting as is due to the increased load, and is commonly, and I think properly, termed the "*indicated horse power of the machinery*." It is also sometimes called "available" power, but evidently without due consideration, that term being only strictly applicable when used to signify the net effective power, and which may be ascertained in many cases independent of indicator experiments.

Should it meet with your approbation, I shall be glad to furnish you with practical illustrations of the above remarks by indicator, diagrams, and calculations taken from engines now at work in this county, previous to going farther into the consideration of the question of the *economy* of the Cornish system.

I am, Sir,
Your obedient servant,
R. ARMSTRONG.

Manchester,
Feb. 11th, 1840

STEAM APPARATUS.

Sir—Having had my attention drawn to the notice of my drying machine in your Journal of this month, page 28, and conceiving that your editorial remarks is calculated to withdraw attention from it, I beg to trouble you with the following explanation :—

The application of steam heat to the purposes of drying is very common, as every one knows; but, in all cases that I am acquainted with, its *direct* application is *to the air* in which the goods intended to be dried are exposed—that is, they are hung up in a heated air. Ventilation is essentially necessary in every operation of drying; but the ventilation which carries off the moisture evaporated from the wet goods, carries off also, a portion of the heated air before it is *saturated* with moisture. There is, therefore, a waste of caloric, or heat, in all systems of drying with which I am acquainted. My object has been to avoid this—to prevent any particle of caloric generated from escaping without performing its duty. The mode adopted in this machine, is not to heat the air, but to hang the drying goods close to the pipes which generate the heat, and in such a manner as shall form an entire sheet, *closing in* and *covering* the pipes. In this case it is evident that no heat can escape *without passing through the wet goods*, for the heat is on one side only of the drying material, which on the other side is a current of air which carries off the moisture as fast as it is expelled. It is by this economy of heat that we are enabled to dry 150 sheets in an hour in the small machine at Abingdon.

The principle may perhaps be better understood by any one acquainted with the common mode of drying woollen clothes in stoves. It is well known that the usual length of a piece of cloth is about 40 yards, and that the rack on which it is hung in a stove is *doubled* in two parallel lines 6 or 7 inches apart, to avoid an extreme length of building. The cloth when hung is stretched on this rack, so forming a double line with an interval of 6 or 7 inches; into this interval or between the double rack, pipes are introduced, the top of the interval being closed by a piece of board connecting the double rack.

It is thus clear that the heat generated from the pipes can escape only *by passing through the cloth*. So effectual is this mode found in the extensive manufactories of Messrs. Wilkins and Co., near Bath, that a cloth which used to be four hours in drying, is now dried in three quarters of an hour, while the fuel is diminished two parts out of three. It follows also, of course, that from the rapidity of the changes, one-fourth of the space formerly required is now sufficient.

As applied to the drying of wool the same advantage is discernable. In this case the pipes are laid under a perforated floor, and the wool so disposed that the ascending heat *may pass through it*. By this means two rooms are found to dry more than was formerly done in six.

I am, Sir, your obedient servant,

James Wapshare.

1, *Great Bedford Street, Bath.*
January 29, 1840.

A PARISH CHURCH BURIED IN THE SAND FOR 700 YEARS. LATELY DISCOVERED.

(From the Churchman.)

Of the many objects to which the attention of your readers is drawn, in the various departments of your paper, there is not one which can exceed in interest the following account of the church of Perranzabuloe, or St. Peran, in the hundred of Pydar, in the county of Cornwall. For more than seven hundred years it had been imbedded in the sand, from which it was rescued, in the year 1835, by the persevering exertions of a private gentleman, William Mitchell, Esq., of Compregny near Truro; and there are many considerations which render a description of the church, in the state in which it was found, very opportune and seasonable at this moment; for its present state affords presumptive and internal evidence of the fallacy of some of those pretensions in which the members of the Romish communion indulge, as to the antiquity of the church, and the pomp and splendour of their services. It would be no difficult matter to prove, by authentic documents, that the first three centuries furnish not the slightest authority for those pompous ceremonies, and those puerile observances which were introduced, and which still continue to outrage the simplicity of the primitive worship. With respect to this particular church, the sand has been accumulating for many hundred years, but when completely removed, the church was found in the most perfect state; and it is a very singular circumstance, that the interior contained none of the modern innovations and accompaniments of a Romish place of worship, from which the evidence is clear and indisputable, that it must have been built at a period anterior to the introduction of the numerous corruptions, &c., of the Papistical communion, and gives sanction to the well authenticated fact, that, in the first three or four centuries, not one of those puerilitles and observances, borrowed either from Pagan idolatries or the Jewish ritual, were known; for the truth is, what we see in Romish places of worship, is nothing but a transfer of what we read from the synagogues of the Jews, or the temples of the Pagans; and which outvie in particular, in splendour and magnificence, the sacerdotal vestments with which those were apparelled who officiated either in the one or the other. The whole of their service is an appeal more to the external sense, than an address to the understanding and the affections. There was no rood left for the hanging of the host, nor the vain display of fabricated relics, no latticed confessional, no sacring bell (a bell rung before and at the elevation of the host,) no daubed and decorated images of the Virgin Mary or of Saints, nothing which indicates the unscriptural adoration of the water, or the no less unscriptural masses for the dead. The most diligent search was made for beads and rosaries—pyxes and Agni Dei—censers and crucifixes. Strange that this ancient church, in which it will be borne in mind, everything was found as perfect as at the time in which it was first imbedded, should so belie the constant appeal to *antiquity*—to the *faith* of their *forefathers*—to the *old religion*, as it is falsely termed, as if that were religion which has not a particle of the simplicity and purity of the primitive church, to sanctify and identify it as a branch from the true apostolical tree! At the eastern end, in a plain, unornamental chancel, stands a very neat but simple stone altar, and in the nave of the church are stone seats, of the like simple construction, attached to the western, northern, and southern walls. With such humble accommodations were our fathers, who worshipped God, in simplicity and truth, content!

From the amiable and intelligent historian of the past and present condition of Perranzabuloe—the Rev. C. T. Collins Trelawny, a descendant, on the maternal side, of the good Bishop Trelawny—a name of which he may well be proud—one of the seven of the glorious company who preferred the gloom of a prison before submission to the mandates of an arbitrary papistical tyrant,—I have had an interesting letter, in which, in answer to my inquiry as to the present state of the parish church, he informs me that it is not in a condition to admit of its being used for any purpose whatsoever, as it is already again entombed in the sand! It was with extreme regret that I received this communication; for so much had my interest been excited by Mr. Trelawny's narrative, which is beautiful and will well repay many a perusal, that I was on the point of fulfilling arrangements I had made for a summer visit to the venerated spot; but I hope that the same enterprising spirit by which it was five years since resuscitated as it were, and recalled into being, will be again interposed to rescue it from its present entombment, and be a temple yet appropriated to the service of the living God! I know not the localities; but who in such a wish does not join? and where is the man whose piety would not grow warm as he worshipped within the hallowed pile of Perranzabuloe, as much as it would within the mouldering ruins of Iona? It may not, perhaps, be unimportant and uninteresting to add, that the tutelar Saint of Cornwall was Peranus, or St. Perran, after whom the imbedded church was named, and that the memory of this saint is still cherished with fond veneration by the people of Cornwall. His annual commemoration is celebrated on the 5th of March. Christianity was first preached in Cornwall by Corantinus, by whom the whole of the population was rescued from Pagan idolatry, and converted to the Christian faith, at the end of the third, and at the commencement of the fourth century.

James Rudge, D.D.

Hawkchurch Rectory, 18*th Dec.* 1839.

ARCHITECTURE AT HOME AND ABROAD.

[We select the following remarks on architecture from an interesting paper which appeared in the last *Foreign Quarterly Review*.]

Owing to the great impulse which has been given to building, since the peace, we have now, throughout the country, a show of very respectable bits of architecture—things of rather ambiguous or negative merit;—Gothic made neat, Grecian made homely, Italian softened down to insipidity. In art our ambition is of a staid, modest, and reasonable kind. Among all our recent works we have few of monumental character, that is, such as testify honourably to the power and taste of the age in which they were produced: scarcely any thing that is really imposing in point of scale, and not less imposing and dignified in style. Our classical school is mechanically correct, frigid, an mannered: we must not look to it for genialty of conception, masterly originality, or happiness of invention. What beauties it gives us are almost altogether borrowed;—transcripts of good originals as regards individual features, which are, however, seldom more than merely put together, instead of being so combined as to produce an ensemble with one and the same spirit pervading every part, a kindred feeling diffusing itself throughout. Owing to an unfortunate littleness and feebleness of manner, buildings large in themselves do not make an impression at all proportionate to their size, but are reduced to the minimum of effect. For grandeur and majesty of aspect Buckingham Palace will hardly bear comparison with that lately erected at Brunswick; and which though by no means unexceptionable, proves Ottmer to be as superior to Nash, as Brunswick is inferior to Great Britain. What the former looks like, or rather does not look like, we all know too well; but the other has a princely air that bespeaks the residence of a sovereign.

Contrasts of this kind are likely to pass for invidious, more especially when they happen to be unfavourable to ourselves; yet the best way of preventing such is by taking a salutary lesson from them for the future, and endeavouring to be first where we now stand almost last. If, however, only to show that we wish to be impartial, and do not blindly defer to the authority of names and reputations, we shall here bestow some notice on the Königsbau, or new palace at Munich, numerous plans and other engravings of which may be seen in the Bauzeitung for 1837. We need scarcely disavow any prejudice *against* Klenze, for we have been charged with being much too favourably disposed towards him our comments, therefore stand a chance of being received as free from bias either way.

The principal, or indeed, only façade, namely, that forming the north side of the Max-Josephs-Platz, extends in a perfectly unbroken line for the length of 406 feet (English). It is 65 feet high, except in the centre, where the height is increased to 95 by the addition of another order, for the extent of eleven windows, or somewhat more than half the length of the front: there being twenty-one windows or apertures in each of the other stories. So far there are the elements of grandeur—length, continuity, loftiness; and when we add to these, massiveness, both with regard to the relative proportion of solid and void, and that arising from the character of the style employed, namely, the older Florentine, it will be taken for granted that it is not at all deficient in greatness of character and the qualities allied to it. Nevertheless we are dissatisfied, less for what it is than for what it is not. Scarcely any pretension whatever is made to originality; the whole is too direct and close an imitation of the Palazzo Pitti; the character also is palpably borrowed and assumed, with this additional drawback of being altogether exotic, and not at all in unison with anything else. As a monument, the original is a highly interesting and impressive work of architecture; as a study, most valuable; as a model, most unfit,—that is, for a palace in the nineteenth century. Recourse might have been had to the same style, but it ought we conceive, to have been differently treated,—in many respects considerably modified; and required a livelier and more captivating expression imparted to it. Instead of this, the physiognomy given to the edifice is by far too repulsive and stern: simplicity has been carried to severity, uniformity pushed to monotony, and to the exclusion of play or contrast of any kind. Moreover, its close general resemblance to the Palazzo Pitti is apt to provoke a disadvantageous comparison, because after all it falls considerably short of that edifice in its mass; at the same time that it is deficient in the powerful contrast produced in the other by the greater solidity there of the lower part. We do not approve of architectural duplicates, more especially when an opportunity offers for a masterly and original production. Such opportunities are far too precious to be negligently thrown away, and ought to be turned to account by creating something that shall carry art onward, and, if possible, give it a new and invigorating impulse.

These objections are no way diminished when we discover that instead of the façade preparing us for the interior, it is quite in opposition to it; the decorations throughout the latter, both architectural and pictorial, being scrupulously, not to say affectedly, Grecian, both in style and character. By Wiegmann, Klenze has been reproached with inconsistency for having in the Glyptotheca employed vaulted ceilings and other forms of Roman architecture within a building externally professing to be purely Grecian:—this, we must say, savours rather of hypercriticism. But in the case before us there is a positive clashing of opposites, because though the apartments are in every other respect perfectly Greek in style and taste, their circular-headed windows contradict it, and disagreeably remind the spectator of the still more decided difference between the taste of the exterior and that of the interior. This, however, is a trivial blemish compared with one very serious and pervading defect; namely, that of the plan altogether, which so far from presenting any kind of beauty, any originality, contrivance, variety, contrast, or play, is exceedingly commonplace and monotonous, and is inconvenient withal as can well be imagined. It is divided on each floor into two enfilades of rooms, all rectangular, either square or oblong, without any intermediate communication, except one part where there is a narrow passage for domestics. As far as arrangement goes, not the slightest attempt has been made at effect. Not only are the principal rooms nearly of the same form, but nearly all of the same size, and so disposed as to occasion inconvenience, and exclude effect also. This will hardly be disputed when we say that the centre of the enfilade in the front of the building divides into a series of small rooms, having only a single window each; and being appropriated as the king's and queen's bed-rooms, dressing-rooms, &c., entirely cut off all communication between those on either side of them. Thus, so far from any climax being produced, all sort of focus and centralization is destroyed, and the parts are disunited and scattered. In fact the whole of this floor can be considered as consisting only of private apartments, notwithstanding that both on the king's and queen's side there is a throne-room preceded by two or three ante-chambers. With the exception of the rooms at either extremity of the front, all the others must be inaccessible to those whose immediate personal attendance on their majesties does not give them the privilege of passing and repassing as there may be occasion of doing.

We will not be quite sure that fresco-painting, when employed to the extent which it is throughout Munich palace, is altogether the very best mode of decoration, or calculated to give the greatest importance to the architecture. For particular rooms and in certain situations, it may be suitable enough; but it is hardly so for sitting rooms, where paintings upon such a scale are apt to become too obstrusive, and by their subjects forming too harsh a contrast—sometimes perhaps almost a ludicrous antithesis—to the familiar details of social life: the opposition becomes that of poetry to prose. A mere picture does not force itself so conspicuously upon the attention; it may be gazed at or not, studied or overlooked; but paintings which constitute, so to say, the local scenery of the whole space, put forth a too direct claim to notice; and though they may be interesting to the casual visitor, cease to make so much impression after constant familiarity. A great deal may certainly be said on both sides; we shall therefore only observe that as decorations for the walls of sitting rooms, subjects in fresco ought, we conceive, to be employed with some reserve, and not suffered to occupy too great a space of surface. In this opinion we are borne out by one who must be admitted a competent authority on the subject, and who has not scrupled to question the propriety of some of the most noted works of the kind. "The far-famed Loggie of the Vatican," says Hessemer, "which ever since they first existed, have been extolled as the greatest models of decoration, are in fact not decoration at all, but a series of paintings covering the surface of both walls and ceilings. As a whole they possess no architectural character; and if the separate pictures, allegories, &c., have very little intimate connection with each other, they have, as such, still less with their situation and with the building itself. As offering an instance of the greatest contradiction between locality and decoration, may be mentioned the works of Giulio Romano in the *Palazzo del Te* at Mantua, with regard to the pictorial but *non-decorative* merits of which I forbear to make any further comments."

After our animadversions upon the Königsbau we can hardly be charged with being indiscriminate partisans of the "Bavarian Ictinus;" nor is it without concern we are compelled to admit that the talents of Klenze have not always been in proportion to the opportunity afforded, or in correspondence with the generous ardour of his royal patron. For the faults we have pointed out we are not indebted to his opponent Wiegmann: since he bestows no notice on any of Klenze's buildings, except merely *en passant*, with brief and general censure, and without entering at all into particular criticism. So far his pamphlet has disappointed us, for though the title makes no specific promise, we did expect that, whether for eulogy or the reverse it would furnish —if not a biography, yet something like an account of the architect's professional career. Instead of this, the writer confines himself almost entirely to the consideration of Klenze's principles and theory, as illustrated in his collection of designs for churches, entitled "Christiche Bauart." Of that production we cannot trust ourselves to speak, not having the volume by us to refer to, nor now recollecting more of it—after a single inspection—than that we considered the designs of rather mediocre quality, and betraying a want of study. The specimens there given of Greek architecture as applied to that class of buildings appeared to us by no means happy models, nor calculated to instruct, as they might have done, had the motives of each subject been explained. As little are we able to say whether the severity of Wiegmann's remarks,—his fastidiousness and captiousness are justified by anything he himself has done, or by greater success attending his own principles; to confess the truth, it is not very clear to us what the latter really are, or what at times he means to say. We may however venture to assert that several of his remarks come home to others besides Klenze, and who, equally bigotted in favour of Greek architecture, are still more cold and pedantic in their application of it; formal copyists, who do not even attempt more than a mere reflection of the antique, and that only in particular features; and while certain forms are scrupulously imitated, fidelity as to the genius and real spirit of the style affected is usually lost,—perhaps held matter of no account. The consequence is that the things so produced are more of less failures—neither antique nor modern—not a skilful adaptation of both, but a harsh and disagreeable conflict of opposing elements and contradictory ideas. Little does it avail for an architect to exhibit the most perfect Grecian portico or colonnade, if he at the same time lets us see that he has trusted to that alone;—that so far from being a necessary portion of his structure, it is a mere adjunct which, though certainly not so intended, chiefly forces us to feel its own vast superiority over all the rest; and the difficulty, if not impossibility, of making that which ought to be principle harmonize with, or even seem worthy of, what is engrafted upon it. Almost invariably do architects forget that by such adoptions they tacitly bind themselves to raise every other part in the same spirit, and to display such powers as shall excuse their appropriating the merit of others to themselves, by making it truly part and parcel of their own work.

Unless this last can be effected with ability, the antique forms will seldom be more than something hung about a modern building,—extraneous parts;—not a consistent dress in which the whole is attired, but mere trimmings and appendages; intended to pass for architectural style, but oftener making it all the more manifest, how deficient the building itself is in character, and destitute of all that conduces to style. Nay, if, on the one hand, columns and other Greek decorations display the great superiority of classical taste, on the other, they lose much of their original value and charm, by being associated with what but ill accords with them. Many a modern soi-disant Greek building reminds us of Cicero's witty question to Lentulus: "Who has tied you to that great sword?"—for with us the question might frequently be: Who has tied that plain and insignificant building to that classical portico?—It also generally happens that such feature is itself impoverished, in order that the contrast between it and the rest may not be too ridiculously glaring.

Diametrically opposed to Klenze, who considers Grecian or Greco-Roman architecture—for he does not reject the Roman arch—to be the only style adapted for universal application, Wiegmann contends that the adherence, or the attempt to adhere, to pure Greek forms in our present and totally different system of construction, is no better than pedantic affectation; and that they ought no longer to be retained by us as models. He further asserts that there can be no such thing as a permanent and unchangeable style in architecture, and that the endeavour to revive at the present day any by-gone style whatever is an absurdity, and very much like trying to force a stream to flow back to its source. According to him, only that which is perfect matter of indifference in itself, and has nothing to do with style, can be indiscriminately adopted as suitable to all times and all occasions. In this there is a certain degree of truth, but somewhat of perverseness also; for a style based upon Greek architecture must upon the whole be allowed to run more in unison with modern taste generally, and prove more capable of application to every diversity of purpose, than any other we are acquainted with. At all events Wiegmann himself has not even attempted to point out how we are to extricate ourselves from the perplexities of his doctrine. He is not one of those who would discard Grecian in order to make way for Gothic, because he rejects the one just as much as the other. Neither do we exactly know how far he really objects to the Greek style, or under what limitations he considers its adoption allowable or even beneficial. That he admits the latter to be possible, is, however, apparent from the commendations he bestows upon Schinkel, observing:

"He is an inspired venerator of Grecian art: but instead of adhering to its externals alone,—to what was more or less conventional in it, and arose out of the circumstances of the times in which it flourished—he has actually penetrated into its very spirit, and in more than one of his works has shown that the rationality and beauty arising out of construction,—which stamps the works of the Greeks as superior to all others, may be made to display themselves even at the present day; and that notwithstanding the great difference between them and the structures of antiquity in regard to many particulars of design, such works partake infinitely more of the same spirit than do the ill understood and lifeless imitations of which Klenze has furnished us so many," viz. in his Christliche Baukunst.

How the above passage can be very well reconciled with the apparently unqualified rejection of Greek architecture even as a type for us moderns, is a point we must leave to Herr Wiegmann himself to explain. In admitting that it is possible to catch the true spirit and genius of Grecian architecture, and to infuse them into buildings adapted to widely different purposes from those of antiquity, he admits that all we ourselves contend for; and in fact, so far advocates the very course we ourselves would uphold;—since few can be more strongly opposed than ourselves to that cold, formal, lifeless imitation of Greek models, which amounts to nothing more than the most servile and tasteless species of copying,—slavishly correct as to certain particulars, but egregiously incorrect—absolutely licentious, in all that regards taste and feeling. We certainly should have been far better satisfied had Wiegmann explained himself so fully as to remove all apparent contradictions, and to leave no room whatever for doubt; still more, had he confined himself more strictly to architecture, instead of entering into vague metaphysical inquiries with regard to the nature and power of art generally, while he is so brief and obscure in regard to many points connected with the former, and which it is highly desirable that either he or some one else should render perfectly clear. What he chiefly proves is, not that Grecian architecture is altogether inapplicable at the present day—such doctrine being wholly at variance with the very high commendation bestowed upon Schinkel for the happiness with which he has in many instances made use of it;—but that the designs in the Christliche Baukunst are nearly all more or less defective, notwithstanding that they were put put forth as models for the instruction of others, nor was their author at all fettered in his ideas by any of those circumstances which generally interfere in the case of actual buildings. After all, therefore, the more important question is left poised in equilibrium, as much being conceded on one hand as is denied on the other. Very little notice, again, is bestowed on the buildings actually erected by Klenze, notwithstanding that many of them—not only the Pinacotheca and Neue Residenz, but Prince Maximilian's Palace, Kriegsministerium, Post Office, &c., are almost entirely in the Italian and particularly in the Florentine style; yet whether the Munich architect's practice is on that account to be considered much more sound than his theory, we are not explicitly told, but left to guess it as well as we can. Now this indistinctness and indecision are to us highly disagreeable: if Wiegmann thought he could even demolish Klenze altogether and give the death-blow to his theory in recommendation of Greek architecture, he should have shown himself more in earnest; and instead of saying a very great deal that amounts to nothing, should have stuck to the main point, and there battered away. If he wishes to have it understood that Klenze is little better than a charlatan in art, he should have put—or tried to put the fact beyond doubt,—should have left us no middle course, but have either compelled us to adopt, or called upon us to refute his arguments.

We are, indeed, favoured with opinions as to one or two of the structures erected by Klenze at Munich; yet mere opinions are very different from argument and criticism: they may be correct or erroneous, just or unjust, but, if received at all, must be taken entirely upon trust, at least by those who have either not the means, or else not the ability, judging for themselves. Thus, Wiegmann dispatches the Königsbau very summarily, calling it a "verballhornten Pallast Pitti;" and again, condemns the Glyptotheca as an unhappy combination of a pure Greek temple with a prison-like mass of building. If it is the absence of windows that constitutes the prison-like character complained of, the same comparison may be extended not only to the temples, but almost all the other public edifices of the ancients, that are remaining; while if some other circumstance produces this effect, it might not have been amiss to explain it to us. Is Wiegmann of opinion that the wings of the façade are too low for the portico?—that, instead of rising above the rest, the portico would have appeared more of a piece with it, if merely stuck on to the building, and made to jut out from it, the whole front being kept of the same height throughout? Or does he think that some windows both within the portico and on each side of it would have improved the whole,—have mitigated the too temple-like character of the one, and the too prison-like aspect of the other? This is what he does not care to inform us; neither does he afford the least clue as to what he considers a more harmonious combination, by referring to something else as an example of it. The most therefore, that we can say in his excuse is, that he is kept in countenance b a great many others who seem to think that the mere expression of praise or blame is sufficient for architectural criticism.

This last remark applies far more strongly than we could wish to the Allgemeine Bauzeitung, where of the various buildings that have been represented and described, scarcely one has had any comments made upon it. Yet this suppression of criticism can hardly have been occasioned by overstrained delicacy, because several would have afforded opportunity for descanting upon the merits of their design. Among these are the Buchhändler Börse at Leipsic, erected by Geutebrüch, the architect of the Augusteum, 1834-6; and Dr. Härtel's house in the same city, by Waldemar Herrmaun of Dresden. Both are in a rich Italian style; and of the two the latter has somewhat the superiority as to extent of façade, its front being 112 feet (English), in length, while that of the other is 108. Besides which it has very much the air of a public building, as there is only a principal floor with an open Corinthian loggia of five intercolumns, above the ground-floor or basement, while the loggia itself is decorated with compartments in fresco. As far as style and beauty of external architecture go, there is scarcely a private mansion in all London that can compete with it, certainly not one of recent date; for even Sutherland House is but a very plain and frigid piece of design in comparison; and both Norfolk House in St. James's Square, and Buckingham House, Pall Mall, are absolutely homely. To say the truth, it may fairly challenge almost any one of our Clubhouses,—at least of those already erected,—for we must not as yet include the Reform Club, whose façade promises to eclipse all its neighbours. We call attention to this example all the more, because we have nothing similar at home: on the contrary, so far from any stimulus having been given of late years to architectural display in the town residences of our nobility and persons of fortune, it would rather seem that the trumpery show and flaring tawdriness of the Terraces in the Regent's Park, and other barrack-like ranges of buildings of that class, have brought the system into disrepute; and it certainly must be acknowledged that the plain and perfectly unassuming brick fronts of houses far more costly and spacious than those just alluded to, have a far more aristocratic look than the others, whose grandeur is nothing more than overgrown littleness, and meanness tricked out in the coarsest finery: truly they may be described as the very Brummagem of architecture.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

ROYAL SOCIETY.

Dec. 19.—Major Sabine, R.A. V.P., in the chair.

A paper was read, entitled,

"*An Account of Experiments made with the view of ascertaining the Possibility of obtaining a Spark before the Circuit of the Voltaic Battery is Completed,*" by J. P. Gassiot, Esq.

The author of this paper adverts to the fact, of a spark invariably appearing when the circuit of the voltaic battery is completed; an effect which Dr Faraday has shown can be easily produced, even with a single series. He then refers to the experiments of Mr. Children, Sir Humphry Davy, and Prof. Daniell, recorded in the Philosophical Transactions; in which experiments, when more powerful and extended series were used, the spark was obtained before contact took place. In order to ascertain, not only the fact of a spark being obtained, but also the distance through which it may be passed, the author had an instrument prepared, which he denominates a *Micrometer Electrometer*, and by which an appreciable space of one five-thousandth of an inch could be measured with great accuracy. He describes this instrument; and relates several experiments which he made with a view to test the correctness of its action. He first prepared 160, and then 320 series of the constant battery, in half-pint porcelain cells, excited with solutions of sulphate of copper and muriate of soda; but although the effects, after the contact had been completed, were exceedingly brilliant, not the slightest spark could be obtained. He was equally unsuccessful with a water battery of 150 series, each series being placed in a quart glass vessel: and also with a water battery belonging to Prof. Daniell, consisting of 1,020 series; but when a Leyden battery of nine jars was introduced into the circuit of the latter, sparks passed to the extent, in one instance, of six five-thousandths of an inch. The author mentions his having been present at the experiment of Prof. Daniell, on the 16th of February, 1839, when that gentleman had 70 series of his large constant battery in action; and having been witness of the powerful effects obtained by this apparatus, he was induced to prepare 100 series of precisely the same dimensions, and similarly placed: but although this powerful apparatus was used under every advantage, and the other effects produced were in every respect in accordance with the extent of the elements employed, still no spark could be obtained, until the circuit was completed; *even a single fold* of a silk handkerchief, or a piece of dry tissue paper, was sufficient to insulate the power of a battery, which, after the circuit had been once completed, fused titanium, and heated 16 feet 4 inches of No. 20 platinum wire. The author then describes a series of experiments made with induced currents. 1,220 iron wires, each insulated by resin, were bent into the form of a horse-shoe. A primary wire of 115 feet, and a secondary of 2,268 feet, were wound round the iron wires. With this arrangement he obtained a direct spark (through the secondary current), sufficient to pierce paper, to charge a Leyden jar, &c. Several forms of apparatus employed by the author are next described, and also a series of 10,000 of Jacubone's piles. With this arrangement he charged a Leyden battery to a considerable degree of intensity, and obtained direct sparks of three-fiftieths of an inch in length. He ultimately succeeded in obtaining chemical decompositions of a solution of iodine and potassium: the iodine appearing at the end composed of the black oxide of manganese.

Jan. 9.—J. W. Lubbock, Esq., V.P. and Treasurer, in the chair.

A paper was read, entitled,

"*On the Construction and Use of Single Achromatic Eye-Pieces, and their Superiority to the Double Eye-Piece of Huyghens.*" By the Rev. J. B. Reade, M. A.

The author observes, that experience has shown it to be impracticable to make a telescope even approach to achromatism by employing the same object-glass with an astronomical, as with a terrestial eye-piece; for if the focus of the blue rays from the object-glass be thrown forwards, as it must be, in order to make it impinge upon the focus of the blue rays upon the terrestrial eye-glass, then there will be produced a great *over-correction* for the astronomical eye-glass, and *vice versâ*. Hence it appears that the application of Huyghenian eye-pieces to refracting telescopes are incompatible with the conditions of achromatism throughout the entire range of magnifying power: and that, in reflecting telescopes, they are incompetent to correct dispersion, because they are not in themselves achromatic. These defects the author proposes wholly to obviate by substituting, for the Huyghenian eye-pieces, single achromatic lenses of corresponding magnifying power, consisting of the well-known combination of the crown, and its correcting flint lens, having their adjacent surfaces cemented together; thus avoiding internal reflections, and enabling them to act as a single lens. The achromatic eye-pieces which he uses were made by Messrs. Tully & Ross, and are of the description usually termed *single cemented triples.*

"*Meteorological Observations made between October*, 1837, *and April*, 1839, *at Alten in Finmarken.* By Mr. S. H. Thomas, Chief Mining Agent at the Alten Copper Works; presented by J. R. Crowe, Esq., H. B M. Consul at Finmarken; communicated by Major E, Sabine, R. A. V. P. This memoir consists of tables of daily observations on the barometer and thermometer, taken at 9 A.M., 2 P.M., and 9 P.M., with remarks on the state of the weather at Kaafjord, in lat. 69° 58′ 3″ N., and long. 23° 43′ 10″ E. of Paris.

J. Whatman, Jun,, Esq., was elected a Fellow.

ROYAL INSTITUTE OF BRITISH ARCHITECTS.

Jan. 20.—Edward Blore, V.P., in the Chair.

A paper was read,

"*On the History of Græco-Russian Ecclesiastical Architecture.*" By Herr Hallmann, architect, from Hanover.

Before examining the existing Russian churches, the author thought it necessary to take a hasty glance at the origin and history of Christianity in Russia, or what amounts to the same thing, at the histoty of those churches. One of the first Christians in Russia was the Princess Olga, who caused herself to be baptized at Constantinople in the year 964; but the era of Christianity in Russia did not commence before the reign of Vladimir the Great. The first church which he caused to be built was that of Cherson, and, a year afterwards, he ordered the construction of the Church of St. Basil, which was, as well as the other, of wood. He sent an embassy into Italy, Arabia, and to Constantinople, to examine the various religions, for the Western and Eastern churches were already separated from each other; and Prince Vladimir, embracing the Greek religion, ordered the baptism of the whole of his people, and was the first to commence destroying the ancient idols. Vladimir built the church of the tithe at Kief; and it is said that, at the time of his death, there were already 500 churches at Kief. Prince Yaroslaf turned his attention still more than Vladimir to the construction of religious edifices; he founded the churches of St. Sophia, at Kief, and another, of the same name, at Novogorod:—they exist, in part, to this day. He also erected the convents of St. George and St. Irene. In 1075 was built the celebrated convent of Petchersky, at Kief, since which time the Russian metropolitans remained subordinate to the metropolitans of Constantinople. Christianity made rapid progress; there remained an uninterrupted communication between Constantinople and Kief, and various marriages between the two reigning houses of the two countries were celebrated. About the year 1124, a great fire destroyed 600 churches and monasteries. In the civil war under Yisaslaf, Kief was taken; it was set on fire: and finally, nearly at the same time that Constantinople was taken by the Venetians, the city of Kief was ravaged and destroyed a second time, never again to realize its former splendour. Moscow is first mentioned in the year 1154, and at that time it was but a miserable village. Daniel of Moscow added to it greatly; and, in the year 1304, under John Danielowitsh, the city was chosen capital of the empire, where, on the 4th of August, 1326, was laid the first stone of the church of the Assumption of the Virgin, in the Krimlin. Under Dimitri Donskoi, the palace of the Krimlin, until then of wood, was erected in stone; and under the reign of Basil the Blind (1425-1462), the church of Russia ceased to be dependant on that of Constantinople, after the taking of that city by Mahomet II. In the year 1487, a palace, known by the name of the Granite Palace in the Krimlin, was built, and in 1499 the Belvedere Palace. Ivan IV. did much for the arts (1534-1584). He likewise renewed the laws for exactly imitating the ancient painting in new churches, whence the reason why all the paintings are so much alike that it is impossible to judge of the epoch, but they may be regarded as a sure type of the earliest Christianity. About the year 1600 the Tzar Boris caused the erection of the magnificent clock-tower, Ivan Valiki, at the Krimlin; and at this period Moscow reckoned 400 churches, of which 35 were at the Krimlin alone. From the time of Peter the Great, and particularly at Petersburg, a change of style took place, and the type of the ancient church was replaced by the absurdities of the *rococo.*

After this general view of the progress of Christian art in Russia, the author turned to the consideration of the Russian church itself, and for this purpose he chose for his examination the cathedral church of the Assumption of the Virgin, at Moscow, as holding the middle rank amongst the existing churches, both as to form and time of construction. (1326.) The plan of the church forms an oblong square divided, and the vaults of which are supported by six equal columns in the interior. Upon a first glance, the form of the Greek cross is not noticed, but it is indicated by the arrangement of the cupolas. The more ancient churches often form an exact square preaeded by a porch, but here the porch is united with the interior of the church, and the arches of the cupolas are placed as if the church still retained the primitive form. The six columns divide the church into four parts from east to west, and three from north to south. On the eastern side are seen three apsides, only divided by the width of a pillar. The middle apsis is bigger than the side ones; this arrangement is found in nearly all the Greek churches, and these apsides indicate the situation of three altars, which are met with everywhere except in small chapels. The altars are not visible to the public; they are covered or concealed by the iconostasis, an arrangement peculiar to the Greek church. This iconostasis (or image-bearer) is merely a kind of colossal skreen, occupying the whole width of the church, thus dividing it into two different parts. The iconostasis has three doors, a principal one in the middle, and two smaller ones on each side. Behind the lateral doors there is a more particular distribution, which is, that on each side stands a second little iconostasis, occupying only the width of the little apsis, but the arrangement of which, with three doors and an altar behind, is analogous to the great one. This is what is met with in the ancient churches; in the more modern, an alteration has been made, so that at the farther end of the edifice are seen, upon the same line, three different distinct iconostasis. Between the principal door and the lateral ones, there is, in front of the iconostasis, on each side, a place for the choristers. Above and before the iconostasis always rises the principal cupola, and in the cathedral churches, at the foot of the apsis, opposite the iconostasis which support the cupola, are seen on the left a baldachin for the emperor, and, on the right, another for the metropolitan. As to the situation of the cupolas, there is generally one principal cupola in the midst of four smaller ones which surround it, and the small ones are nearly always at the four angles of the Greek cross. In every church, the iconostasis is the principal part, which ought to be a representation of the celestial empire; it is composed of four or five different tiers, four of which are indispensable. Each tier is composed of an unequal number of pictures of saints, painted on tablets or long square surfaces, the place of which is rigorously fixed. On the first tier are the three doors; the middle door (in two foldings) ought to be ornamented with the Annunciation of the Virgin—the Virgin on one of the foldings, and the Angel on the other—accompanied with the heads or emblems of the four evangelists; on the right of the door is the effigy of Christ, on the left that of the Madonna; on the right, after that of Christ, is placed the picture of the saint or of the festival of the church: then come the little doors already mentioned, but they ought only to be single doors; above the little doors is placed, on the left, the Greek cross, on the right the cross of Moses, symbols of the New and the Old Testament. Such are the indispensable arrangements of the first tier. The ground of the whole iconostasis is gilt. On the second tier, in the middle, is Christ on a throne; and on the right is St. John the Baptist; on the left the Madonna (without the child): after that appear, on each side, two archangels and six apostles. On the third tier, in the middle, is seated the Madonna, holding the infant Jesus on her knees; on each side of her are seen the effigies of the prophets. On the fourth tier is placed God the Father, on a throne, with the infant Jesus; on each side the pictures of the patriarchs of the church. Sometimes there is a fifth tier, upon which are seen representations of the history or of the passion of the Saviour. The other parts of the church are ornamented with paintings on a gold ground. The forms of the exterior are very simple; with respect to the upper part of the edifices the adoption is nearly general of the oriental manner of the eleventh and twelfth centuries—namely, the entire rejection of the horizontal line of a cornice, as the crowning of the building for the substitution of arched, or pointedly arched forms—determining the extrados of the vaults. This cylindrical covering is well known in the east, and is even to be seen in Italy at the present day, in the environs of Naples. These extrados are painted in all colours. The Russian churches derive a peculiar aspect from the cupolas which rise above the roof. On beginning to build churches in the eleventh century, the prevalent manner in the east was naturally imitated—that is to say, such cupolas were not employed as are seen, for example, at St. Sophia at Constantinople, or at Venice, but such as are to be met with in the churches of those times in Greece. The form of the cupolas themselves, which are generally placed on an octagonal drum, are extremely various, some having the form of a half globe, others of a flat onion, a bud, or a long pear, &c.

Mr. Hallmann next drew a parallel between the Russian, the original Greek, and the western churches which bear traces of Greek influence. The first Christian temples under Constantine in the east, and even at Rome, were circular or octagonal, and were surmounted by a single dome: afterwards the same disposition we find in the interior of the churches, with few variations, but the exterior assumes the square form, as in the church of Sergius and Bacchus, and St. Sophia at Constantinople. This latter church already evinces in the interior the form of a Greek cross, and may be regarded as the basis of the Russian churches. At the end of the seventh century began the difference of dogmas between the iconoclasts and iconolaters, which ended in the rupture between the churches of the east and the west. From this time, probably, may be dated the custom of not allowing carved images or statues in Greek churches, except statues of angels; wherefore we see *niellos* upon bronze doors of Greek origin, even in Italy, as at Monte St. Angelo, at Canopa in Apulia, and at Amalfi, &c. Another difference, probably one of the consequences of the schism, was the establishing, at each side of the grand altar, a secondary one; not, as in Roman Catholic churches, at the ends of the transept, or in side chapels, but at the extremity of the church, in the same direction as the grand altar. Their place is always indicated by a niche or apsis. In the Russian churches which commenced in the same century, it has been shown that this disposition became typical, and that it is quite conformable to the division and subdivision of the iconostasis. This disposition is to be met with in nearly all the churches of the eleventh, twelfth, and thirteenth centuries, at Bari, Trani, Malfetta, Otranto, &c., where the Greek worship then prevailed. This situation of the altars is seen even where the churches are Roman Catholic, as at Palermo, in the chapel at Martorana and Monreal, and even at Amalfi and Ravello. Considering that this disposition is found in churches of an earlier date, as St. Parenze in Istria, at St. Fosca, &c., and that perhaps even the form of the ancient basilicas might have given rise to this disposition; it may be very possible that the Greeks preserved this form as an ancient custom of the Church, and that it was the Roman Catholics rather who departed from it. This observation is corroborated, if we observe that the ancient writers tell us that there was, on the left of the altar, a place for the deacons of the church, afterwards called the sacristy, and, on the right, an altar for the consecration of the bread and wine for the communion. In Roman Catholic churches, we always see a sacristy at the side of the church, but, in the Greek Church, the priests always robed themselves behind the iconostasis; and, up to the present day, there is an altar at the side of the present one for the preparation of wine and bread. Another very remarkable difference in the Russian churches is the not having separate places for the women, and there is not a single remnant of a tribune or gyneceum—a circumstance the more astonishing as this disposition is met with not only in the East, but also in nearly all the churches on the coasts of the Adriatic Sea, at Bari, &c. The author concluding by passing in review the modern churches erected after Peter the Great, especially at Petersburgh, and by exhibiting and explaining an original design for a Græco-Russian church exquisitely drawn, and embellished with all the attractions of that gorgeous colouring, which is so peculiar a feature in those edifices.

REMARKS ON ARABESQUE DECORATIONS, AND PARTICULARLY THOSE OF THE VATICAN.

Read at the Institute of British Architects, Feb. 3, 1840,

By A. Poynter, Esq., one of the Secretaries of the Institute.

It is an observation which has been very frequently repeated and very variously expressed, that the proper use to be made of the study of the ancients in their works of art, is not to copy, but to endeavour to think like them. Among the principles which guided them, none is more important, or has exercised a greater influence in bringing ancient art to perfection, than that which has been so well condensed into one line by Pope, that

" True Art, is Nature to advantage dressed ;"

and if we wish to rival the ancients in the productions of what is at once excellent and original, we must like them seek for original types in the works of nature.

That such a course of study would be analogous to the practice by which the ancients themselves attained so high a reach of perfection, we have sufficient proof. Nothing in art can be imagined more conventional than the orders of architecture, and yet Vitruvius endeavours to derive them all from simple principles. Vitruvius sufficiently indicates it to have been a received principle that the most conventional forms—and a more conventional form than the Corinthian capital it would be difficult to point out, were supposed to have been originally suggested by the forms and accidents of nature.

To follow up the subject of these remarks, would open a boundless field of inquiry. I offer them in the present instance merely as prefatory to a few observations on the arabesque style of decoration, illustrated by a short review of the arabesques in the Loggia of the Vatican, of which the engravings are before you. I propose to inquire how far the artists who designed and executed these arabesques have been indebted to the antique, and how far they have modified the hints derived from that source, so as to adopt their compostitions to the purposes they are destined to fulfil.

In speaking of these sorts of compositions as arabesques, I of course adopt the term as it is commonly understood, and need not explain that we disregard both the etymology and the meaning of the term in applying it to the paintings and stuccoes of antiquity, which represent not only foliage and fruits, but also beasts of every species, and imaginary creatures combined and interlaced together. These decorations have also acquired the name of grotesque, from the grottoes or underground buildings in which they have been found—a term we have perverted still more from the sense in which the Italians invented it.

It is remarkable, that the only mention Vitruvius makes of this style of decoration is in reprobation of it—but he describes it so accurately, that the passage is worth repeating, if for no other reason. After pointing out and classifying what he considers legitimate objects for painting walls, such as architectural compositions, landscapes, gardens and sea pieces—the figures of the gods, and subjects drawn from mythology, and the poems of Homer. He proceeds thus, "I know not by what caprice it is, that the rules of the ancients—(observe, that Vitruvius looks up to the ancients in his day, that is to say, to the Greeks)—who took truth for the model of their paintings, are no longer followed. Nothing is now painted upon walls but monsters, instead of true and natural objects. Instead of columns we have slender reeds, which support a complication of flimsy stems and leaves twisted into volutes. Temples are supported on candelabra, whence rises, as from a root, foliage on which figures are seated. In another place we have demi-figures issuing from flowers, some with human faces, others with the heads of beasts, all things which are not, never have been, nor ever can be. For my own part, I hold that painting is to be esteemed only so far as it represents the truth. It is not sufficient that objects be well painted—it is also necessary that the design be consonant to reason and in no respect offensive to good sense." Pliny also laments that in his time, gaudy colouring and quaint forms were held in greater estimation than the real beauties of art. But with all deference be it spoken, there is another side to the question, which these great authorities seem to have overlooked. Conventional decorations of this kind were within the reach of thousands to whom paintings in the higher branches of art were inaccessible, and a more general diffusion of taste must have been at once the cause and effect of their universal adoption—how universal, the remains of Pompeii reveal to us. If we examine the ancient arabesques independently of these prejudices, we shall find endless beauty, variety and originality; graceful details combined in consistent and ingenious motives and analogies, and great skill and freedom in the mode of execution. We shall also find reason to doubt whether the introduction of the arabesque style really had the effect of discouraging painting of a higher class, since even at Pompeii, poetical compositions of great merit are frequently combined with the lighter ground work of the general decoration.

However fanciful and capricious the arabesque style may at first sight appear to be, there can be no doubt that it may be treated according to the general fixed principles of art, and that the artist will be more or less successful as he keeps these principles in view. A due balance of the composition is essential, so that the heavier parts may sustain the lighter through every gradation, and there must be such a disposition as not to cover too much or too little of the ground. Unity of design is to be studied in a connexion of the parts with each other, and in the harmony of the details and accessories, which ought as much as possible to tend so some general aim. It would lead us much too far to enter upon the subject of colour—but it may just be observed, that in the ancient decorative painting, the balance of colour is strictly attended to. Their walls usually exhibit a gradation of dark pannels in the lower part—a breadth of the most brilliant colours in the middle and principal division, and a light ground thinly spread with decoration in the upper part and in the ceiling—an arrangement dictated by the natural effects of light and shade, and reflection. As lightness and grace are the peculiar attributes of arabesque, the foliage which forms its most fertile resource should never be overloaded; its details and modes of ramification ought to be drawn from nature. The poems of Schiller and other German authors have lately been published with a profusion of arabesque decoration in the margin, which are well worthy of attention, both for the ingenuity with which they are rendered illustrative of the text, and for the accuracy, the *botanical* accuracy, with which some of the foliage and flowers are represented, and which form one of the greatest charms of these clever and original compositions.

Although the paintings in the Loggia of Vatican pass under the name of Raffaelle, it is not pretended that they are the work of his hand, nor were his designs. He was indeed the originator and director of the whole, and the character and influence of his taste is visibly stamped on every part. But his coadjutors in the work were artists whose names are inferior to none in the Roman school but his own, such as Guolano Romanino, Perino del Vaga, Benvenuto Tisi, and others, who were occupied not only in the execution but the invention of the details. Francesco Penni, and Andrea da Salerno are particularly noticed as being employed for the figures. Giovanni da Udino for the fruits and flowers, and Polidoro Caravaggio for the releivos. It may be worth digressing to mention, that M. Quatremere de Quincy is of opinion that the sculptures of the Parthenon were produced by similar means, Phidias there performing exactly the same part as Raffaelle in the Vatican—and it is indisputable that the combination of unity of design, with variety of detail which characterizes gothic architecture, could have been produced only by the same system, and by employing the minds as well as the hands, of those by whom the decorations were executed. When we see perfection attained in three distinct styles of art, in three distinct ages, by means precisely similar, it is not too much to assume that these means are probably the right ones.

The Loggi ofa Raffaelle, as you will see by the large section which forms one of the permanent ornaments of this room, is an arcade in thirteen compartments. The arches are open, or at least were so originally, toward the court of which the Loggia forms one side. The opposite side, that namely which is represented in the drawing before you, is a wall pierced with windows, one in each arch, giving light to the suite of rooms which contain the great frescoes of the prince of painters. The ceiling of each compartment forms a square cove, on the sides of which are the pannels containing the series of scriptural paintings, the engravings from which are known as Raffaelle's bible. These are his own designs, and some are known to have been touched with his own hand. Both the lateral and cross arches are supported by pilasters about 16 feet high, panelled, and decorated with coloured arabesques on a white ground. It is to these pilasters the present remarks will be confined. Each pilaster on the wall side is flanked by a half pilaster, in which the arabesque is carried through on a smaller scale of composition.

The description of these pilasters will be taken in the order in which Volpato has engraved them, that is to say, beginning on the side next the wall.

I. Notwithstanding the great variety in the composition and details of these works, we shall find a general unity of design pervading throughout, with the exception of the last five of the series, which will be particularly noticed in their turn. Whatever form the composition may take, it is rendered subservient to the introduction of four medallions, or tablets relieved from the back ground in stucco, of contrasted shapes—one like an antique shield—the next circular—the third rectangular—and the fourth spindle-shaped. These medallions occupy the upper part of the pilaster to the extent of about one-third of the whole panel, while the lower part, to the height of the dado, or somewhat higher, is generally filled in such a manner as to afford a *weight of colour*, sufficient to support itself by the side of that member of the architecture, and the marbles introduced into its panels, following in this respect the practice of the ancients. These medallions might appear to violate the due balance of the arabesques if they were identified with them—but the composition is rescued from that fault, by the separate character given to the decoration of the medallions, and by their being detached, and hung as it were, independently upon the back ground. In the general arrangement of the whole, these medallions perform a most important part, connecting the pilasters with the panelled stuccoes adjoining, by their relief, and by means of an accordant style of decoration and a similarity in the subjects represented upon them, neither of which could have been well embodied in the arabesque itself.

It must be admitted that these compositions considered separately are somewhat unequal, and the examples to be first passed in review are by no means the best, but instruction may be derived from a consideration of their defects. The clusters of natural fruit and foliage which surround the windows are continued throughout the series of arches. and are greatly varied in detail. though precisely similar in composition. There is nothing conventional in these festoons—the clusters are simply connected together by a string, and are composed of the most familiar objects rendered with perfect truth. The melon, the orange. the chesnut, the tomata, the olive, grapes of different kinds. pomegranates. gourds of every description. pine and cypress cones are those which most frequently recur, with their foliage and blossoms. The artist has not even disdained the cabbage, cucumber, and the onion. This example may teach us that objects for decoration may be sought throughout the whole range of nature's works with hopes of success.

Unity is again lost sight of in the design No. 18. but the different objects which compose it. are harmonized upon a totally different principle from any which have been hitherto examined, and the effect is rather dependant upon colour than on form. The panels contrast brilliantly with the white back ground, and are relieved and rescued from heaviness by the sharp dark lines which surround them: this is quite antique.

Having now completed the review of this series of arabesques, it is not my intention to detain you by any lengthened observations upon them, such as occurred. having been expressed on the immediate occasions on which they arose. In the resources which the decorative artist can call to his aid, the moderns have greatly the advantage over the ancients, since we possess their materials and our own also. For as long as ancient authors are read, and ancient art appreciated, so long will allusions to the manners, customs, poetry and religion of antiquity be familiar to us. and the symbols to which they gave rise be universally understood; indeed numberless allusions of this kind are constantly before us. and are so familiar. that we forget to inquire their origin. In personification, and the embodying of abstract ideas, the field is as open to us as to them, and we see to what advantage it may be turned by the examples we have just passed in review, and if we add to all these objects, those derived from the useful arts and sciences which may be turned to account in the hands of the skilful decorator. his resources may be considered boundless. For as we have seen in these examples, it is not the familiar aspect of any object which should banish its representation from works of fancy. Every thing depends upon its proper application. The ancients made the best use of whatever they considered most appropriate. and we must endeavour to do the same. Thus on the pedestal of the column in the Place Vendome. which is a professed imitation of that of Trajan, modern arms and habiliments occupy the place of those of the Roman period, sculptured on the original. Whether this translation be as well executed as it might be, is not now the question—I merely notice it as being right in principle. One fertile source we have totally unknown to the ancients, from which materials may be drawn for decoration. Carrying with them the invaluable quality of being in all cases significant as well as ornamental—I mean the science of heraldry —I cannot help thinking that the Greeks who used so much diversity of colour in their architecture, would have availed themselves liberally of the tints of heraldry in their decorations had they been accustomed with it. From the personal allusions it conveys it might be made a much more important feature than it even now is in the decoration of private as well as public buildings, and we have only to study the works of the middle ages for invaluable hints for the work in which it may be applied. The mere display of shields of arms is but one. We shall find heraldry intimately woven into the ornaments of our gothic buildings, and he who can read its language may often understand an allusion in what may appear at first sight a mere decoration. Thus one of the mouldings of the tomb of Humfrey Duke of Glocester, at St. Albans, is filled with an ornament, which on examination resolves itself into a cup containing flowers, a device assumed by that prince, says a MS. in the College of Arms, as a mark of his love for learning. Heraldry has not been neglected in modern Italian art, and I remember in particular a very well imagined arabesque in the Town-hall at Folisno. The ceiling is covered with foliage. spreading from the centre.

In the pilaster No. 3, many of the details are in the true spirit of the antique—the single figures are less so. An ancient painter would not have placed them on a scrap of earth. In the Pompeian decorations. the detached figures—I do not speak of such as are inclosed in frames—but the *detached* figures, partake of the artificial character of the style to which they are adapted, and if they are not represented as floating in the air, they stand upon a bracket, or a mere line, or on any thing but the natural ground.

My objection to some of the terminal figures is, that they are improbable. Improbable I mean upon certain postulates, which it is necessary to assume before we can reason upon these imaginary compositions at all. The mythology of the ancients has peopled the elements with beings compounded of the human and brute creation; their intelligence being indicated by the first. and their fitness for the region they are supposed to inhabit by the second. There is nothing in ancient art in which greater taste or judgement is displayed than in some of these combinations. The animal functions appear in nowise compromised by the mere interchange of corporal members; between different species. Such combinations therefore, as long as they involve no glaring disproportions, present nothing repugnant to the mind, and we are so familiarized to them. that we pronounce upon the success of the representation of a triton, a satyr, or a centaur, with as little hesitation as we might upon that of any of the animals of which they are compounded. We are equally ready, or perhaps owing to a stronger association of ideas. *more* ready to admit of aerial beings, supporting themselves on wings, floating in the ether, or alighting upon a flower without bending the stalk; though these are, in fact. less probable than those born of the ocean or the earth. Between animal and vegetable life there is also a sufficient analogy to attach some probability. or at least to afford an apology, for the graceful combinations between these two kingdoms of nature, invented by the ancients, and adopted to a very great extent in the compositions before us; but, when we come to combine animal life with unorganized matter, the probability ceases, and if, as in the case before us, the unorganized portion is something artificial, and totally out of proportion, besides the combination becomes intolerable. Thus we acquiesce in the metamorphoses of Ovid or the Arabian Nights, as long as certain analogies are observed—but the transformation of the ships of Eneas into sea nymphs, is a violation of probability to which nothing can reconcile us.

No conventional form has been more abused than the terminus; intelligence and immobility are the attributes which the ancients intended it to embody, but their apposite creation is totally different from anomalous composition like this into which it has been tortured.

In No. 5 we arrive at a superior composition, for it must be repealed; we are examining the decoration of a single member of an extensive *whole*, and that, however beautiful each may be, unity is a beauty in addition. No object in decoration has been so extensively used as the scroll. The ancients do not appear to have been afflicted with an unhappy craving for novelties, nor to have been haunted with the apprehension that beautiful forms of composition would become less beautiful by repetition. When the most appropriate forms in architecture and decoration were once ascertained, they were continually repeated, but marked with a fresh character, and stamped with originality by those refined and delicate touches which were all-sufficient when they were properly appreciated. In the same manner with regard to the ever-recurring form of the scroll, as long as the foliage and ramifications of nature are unexhausted. so long will it be capable of assuming an original character in the hands of the skilful artist. A striking illustration of this position may be drawn from the arabesques in the palace of Capsasola, where the pilaster of the Loggia are decorated with scrolls, all similar in composition. but each formed of a different species of natural foliage without the intermixture of any thing conventional except the regularity of the convolutions.

For the magnificent scroll before us we are indebted to the antique; it is an imitation of the well known frieze of the Villa Medici, but the artist has made it his own by the skill with which he has adapted it to his purpose, both in proportion and colour. Nothing can be more happy than the manner in which the upper part grows from the original design. I would particularly call your attention to the animals—the squirrels, the mice, the lizards, the snake, the grasshopper, and the snail, dispersed about the branches, so well calculated to fill the spaces they occupy, and at the same time producing a variety which would have been wanting, had the foliage only been extended with that object. To the scroll in the half pilaster it is to be objected that it is a repetition in small, of that in the principal compartment—but if examined separately, it will be found full of instruction from the union it displays of natural objects with conventional forms. The spiral line of the antique scroll is evidently drawn from the natural course of climbing plants, —it is conventional in its openness and regularity. The involucra of plants furnish the hint for the base from which the antique scroll is made to spring and the spathes of the liliaceous tribe for the sheaths, of a conventional repetition of which. the ancient sculptured scrolls principally consist. Thus far for the general elements of the antique scroll, which the artist has implicitly followed in the example before us; but he has enriched his composition without disturbing its unity, by making every sheath produce a different branch. drawn immediately from nature. The birds present an equal variety. and are occupied according to their natural habits. in feeding on the berries and buds. or on the variety of insects which are also introduced. The arabesques in the side panels are to be particularly noticed in this example. A *motion*, however slight. is always to be desired, and here we see a very graceful one in the two winged boys who dip into a vase-like fountain. The winged bear which occupies the medallion may be noticed as a violation of probability. A being to cleave the air should not be selected from the most heavy and awkward of animals; it is undoubtedly intended for a *jeu d'esprit*, and is quite in the spirit of the antique. The ancient frescoes are full of such whimsical combinations, but always as in the present instance, occupying a subordinate place.

No. 7. is one of the most remarkable of the series. In this the artist has ventured, and with the most perfect success, to discard every thing conventional, and to represent a natural tree, balancing its irregularities of ramification and foliage by the numerous birds which occupy the branches, when they may be supposed to have been collected by the call of the bird-catcher, who is concealed in the underwood with his bird-call in his mouth. One bird, fettered by a limed twig, is about to fall into his hands. It is impossible to admire too much the skill with which this simple *motion* is worked out.

It may be observed in reference to Nos. 4 and 11, that folds of drapery are too broad and heavy to be successful in arabesque—its effect is seldom pleasing. I must also protest against the birds which crown this composition. Nature has provided a variety which makes it quite unnecessary to seek novelty by combining the neck of one species and the tail of another with imaginary wings. The first impression is, that these birds are meant for swans; the second, and abiding one, that the artist did not know how to draw a swan: he has not mended them by dressing them in trowsers.

In No. 15, the artist has chosen the apparently incongruous subject of fish to combine with his foliage. In a painting by Hogarth, we see in the fashionable furniture of one of his scenes, a composition of foliage inhabited by fish instead of birds, although this absurdity be intended as a caricature of the talk of the day, it is no great exaggeration of the fact. In this design, the foliage and the fish are brought together without the slightest violation of probability; the fish have been hung to the branches—the variety of their forms and colours produces an admirable effect, and above all, they are perfect in the condition, more especially indispensable in objects not intrinsically graceful or pleasing, of being represented with the most absolute truth to nature.

INSTITUTION OF CIVIL ENGINEERS.

SESSION 1840.—ANNUAL REPORT.

The Council of the Institution of Civil Engineers, on resigning the trust confided to them by the last annual general meeting, solicit the attention of this meeting, and of all those who are interested in the welfare of the Institution, to the following report on the proceedings and on the state and prospects of the Institution at the close of this the twenty-first year of its existence. At the last annual general meeting, the council of the preceding year had the gratification of congratulating the Institution on its then assembling in its new premises under circumstances which furnished so advantageous a contrast with the condition of earlier years, and such convincing evidence of the steady progress and success which had attended the labours of the Council and the co-operation of the general body. And though the year which is now closing upon you may not have been marked by events of so striking a character as the preceding one, the council nevertheless experience the highest degree of satisfaction in reviewing the proceedings of the session of the year so auspiciously commenced. Aware of the more extensive duties and increased responsibility entailed upon them, the council have endeavoured so to direct the affairs of the Institution as to keep pace with its growing importance; and they can with confidence assert, that the proceedings of the last session have not been inferior in interest or importance to those of any preceding session; whilst the attendance at the meetings, and the anxiety which is evinced by strangers to become acquainted with the proceedings and objects of the Institution, show the estimation in which it is held both at home and abroad, and fully warrant the most sanguine anticipations of its future and continually increasing success.

The attention of the last annual meeting was directed to the expediency of some alteration in the existing laws, particularly with reference to the election of officers and the number of the council. It was suggested that the annual election of the council should be conducted in a somewhat different manner from that hitherto pursued; that a greater number than that constituting the council should be nominated, and that, consequently, each person at the annual general meeting, instead of, according to the then existing practice, erasing one name and substituting another, should erase as many names as the number on the balloting list exceeded the constituted number of the Council. It was also suggested, that it would be for the advantage of the Institution that the council should be increased by the addition of two members: that as some members of the council are frequently prevented by professional engagements from regular attendance, the council should be enlarged to as great an extent as might be consistent with the true interests of the Institution. These and some other suggestions for the better regulation and stability of the Institution, were subsequently submitted to a general meeting of the members, and now constitute part of the bye-laws of the Institution.

The practice of other societies in publishing their transactions in parts, containing such communications as were ready at frequent and short intervals, was briefly touched upon in the last report, and was discussed in considerable detail at the last annual meeting. Such is the nature of some communications, that delay in their publication may be considered not only as a positive injustice to the author, but as detrimental to the cause of practical science, and the best interests of the Institution; and if the publication of such papers be delayed until a whole volume is ready, authors will inevitably avail themselves of other channels for bringing their labours before the world. Add to which, when a whole volume containing many valuable plates is to be published, the sources of delay are numerous, and such as cannot be avoided. The council conceive that the experience of the past year has fully borne out the preceding views, and shown the great importance and value of prompt publication. Early in the session the Institution received a most valuable communication from your member, Mr. Parkes. It was considered desirable that the publication of this communication, forming, as it did, a continuation of his researches already published in the second volume of the transactions, should not be delayed. No other communications being then ready for publication, the council resolved to publish it at once as the first part of the third volume. This has now been for some time in the hands of the public, and the number of copies which have been disposed of shows the great desire evinced to obtain these papers as soon as published. The council have also had still further proof of the importance of this plan. The Institution received, during the last session, several communications well suited for publication in the Transactions, and among them, the continuation and conclusion of that already mentioned by Mr. Parkes. Preparations were made for the immediate publication of these papers in a second part; difficulties and delays which could not have been foreseen or prevented, occurred in the publication of some of them, and thus the second part contains but two instead of the nine communications originally destined for it. The greater portion of the remaining seven papers are already printed and the plates engraved, so that the third part will be in the hands of the Institution in a very short time. There are several other valuable communications in the possession of the Institution now in the course of preparation for publication, and which will appear as soon as circumstances will permit.

The minutes of proceedings have been printed at such short intervals during the session, as the abstracts of papers and minutes of conversation would furnish sufficient materials. The council conceive that great advantages may, and indeed have, resulted from a publication of this nature. An authentic account of the communications is thus immediately furnished, attention is continually kept alive to the subjects which are brought before the Institution, and the statements there recorded have elicited very valuable communications, which otherwise would probably never have been brought forth. No one can turn over the minutes of the last session without remarking the number and the diversity of the facts and opinions there recorded, very many of which were elicited by the statements contained in some written communication, or casually advanced in the course of discussion.

The council cannot omit this opportunity of insisting on the importance of these discussions in promoting the objects which the Instituion has in view. The recording and subsequent publication of these discussions are features peculiar to this Institution, and from which the greatest benefits have resulted and may be expected, so long as the communication of knowledge is solely and steadily kept in view. It would be easy to select many instances during the last and preceding sessions, of some of the most valuable communications to the Institution owing their origin entirely to this source. The first communication from Mr. Parkes arose entirely out of the conversations which took place on the superior evaporation of the Cornish boilers being referred to as one cause of the great amount of the duty done by the Cornish engines. The communication by Mr. Williams on peat and resin fuel owes its origin to his being accidentally present at the discussion on the uses of turf in the manufacture of iron; whilst that by Mr. Apsley Pellatt, on the relative heating powers of coke and coal in melting glass, arose entirely from the discussion of the facts stated by Mr. Parkes respecting the superior evaporation produced by the coke from a given quantity of coal than by the coal itself. And lastly, the extremely interesting and highly valuable discussions at the commencement of last session on the uses and applications of turf; and on the extraordinary coincidence between the results obtained by Mr. Lowe, Mr. Parkes, Mr. Apsley Pellatt, and Marcus Bull, of Philadelphia, experimenting as they did with totally different views, and under totally different circumstances, must be fresh in the recollection of all present.

But, besides the positive advantages which have thus resulted, and may be expected, from a steady adherence to these practices so peculiar to this Institution, there are others of the greatest value to those engaged in practical science. By this freedom of discussion statements and opinions are canvassed, and corrected or confirmed, as soon as promulgated, the labours of authors and claims of individuals are made known and secured as matter of history—and attention is continually kept alive to the state and progress of knowledge in those departments of science which it is the especial object of this Institution to promote. The council trust, therefore, that those individuals who have stored up knowledge and facts for many years past, and devoted themselves to some particular branch of science, will consider how much they have in their power to contribute, and how great is the assistance which they can render to the labourers in other branches, and, above all, to those who are ambitious of following in their steps, by freely communicating, either orally or in writing, the knowledge which they have collected; so that the records of the Institution may be unparalleled for the extent and correctness of the information which they contain.

The council have endeavoured from time to time to direct attention to subjects on which it was conceived communications were needed or desirable, by proposing such subjects as objects for the premiums, placed at the disposal of the council by the munificence of the late president. The communications sent in compliance with this invitation have not been numerous. Two, however,—one by your associate Mr. Jones, on the Westminster Sewage, and the other by Mr. Hood, on Warming and Ventilating,—seemed to call for some special mark of distinction.

The communication by Mr. Jones is of the most elaborate and costly description. (*See Journal*, vol. 2, p. 311). The council conceived that, in awarding to Mr. Jones a Telford medal in silver and 20 guineas for this laborious communication, they were bestowing a suitable mark of approbation on the author of a record which is nearly unparalleled, and must be of great value as a source of information in all future works of this nature, when other, and particularly foreign, cities carry into effect a system of drainage, in which they are at present so deficient.

The council cannot pass from this subject without expressing the obligations which the Institution is under to the chairman and the commissioners of the sewers of the Westminster district. On its being intimated to them that the council wished some account and record of the work over which they preside, permission was immediately given for any person desirous of preparing such account to have free access to all the documents in their possession relating to this subject, and to make such extracts or copies therefrom as could in any way contribute towards this object.

The communication by Mr. Hood contains a detailed account of the principles on which the salubrity of the atmosphere in crowded rooms depends, and the various methods which have been adopted for warming and ventilation. (*See Journal*, vol. 2, p. 469). The importance of ventilation, and the success which has attended the adoption of mechanical means in the manufacturing districts, are subjects worthy the attention of all who study the health of those who, from choice or necessity, are exposed to the generally unwholesome atmosphere of crowded apartments. This subject is of the highest importance to the manufacturing poor of this country, who are compelled to work in crowded rooms at high temperatures. The council are aware that much has been done towards this object in some of the large cotton works of Great Britain, and they hope ere long to obtain some detailed account of the means by which this has been accomplished, and the results which have ensued.

The council have also awarded a Telford medal in silver to your associate, Charles Wye Williams, for his communication on the Properties, Uses, and Manufacture of Turf Coke and Peat Resin Fuel; and to Mr. Edward Woods, for his communication on Locomotive Engines.

The various applications of peat as a fuel had been repeatedly the subject of discussion at the meetings of the Institution, and this communication may (as has been already noticed) be attributed to the discussions then going on. (*See Journal*, vol. 2, p. 145).

The communication by Mr. Edward Woods, published in the second volume of the Transactions, will always bear a prominent place among the records of practical science, as one of the earliest and most accurate details on the actual working of locomotive engines. The first communication was received early in the session of 1838. (*See Journal*, Vol. 1, p. 139.) The author was thought capable of adding so much to his already valuable communication, that the council referred it back to him for this purpose, and it was not received in the form in which it appears in your Transactions till after the premiums for that session were awarded. But this communication (notwithstanding the interval since it was laid before the meeting) will probably be fresh in the recollection of most present, from its giving an accurate account of the progress of the locomotive engines on the Liverpool and Manchester Railway from the opening of that important work. The experience of engineers had at that time furnished them with but little knowledge as to what were the most essential requisites in railway engines, and the advance of knowledge, as shown by the history of the locomotive engine on this railway, is a most interesting and instructive lesson to every one who would study the progress of practical science and improvement. Great alterations were found necessary in the strength of the parts, in the weight of the engines, in the road, and the number of wheels. The first engines were gradually adapted to the necessities of the case, and the arrangements then resorted to as necessary expedients have now been adopted into the regular and uniform practice. Besides the extreme interest of that which may be termed the history of these improvements, the communication is replete with theoretical principles as to the working of locomotives, and the advantages and disadvantages incident to peculiar practical adaptations. It would exceed the limits of this report to do more on the present occasion than briefly to state that this paper contains extended remarks on the relative advantages of four or six wheels, of inside or outside framings, of crank axles or outside crank pins, of coupled or uncoupled engines. The council would point out this paper to the junior members of the profession, as an example of how great a service may be rendered by simply recording what passes under their daily observation and experience.

The council have also adjudged a Telford medal in bronze and books to the value of three guineas to Mr. R. W. Mylne, for his communication on the Well sunk at the reservoir of the New River Company at the Hampstead-road, (*see Journal*, vol. 2, p. 311); to Lieutenant Pollock, for his drawings and description of the Coffer Dam at Westminster Bridge, (*see Journal*, vol. 2, p. 311); and to Mr. Redman, for his drawings and account of Bow Bridge.

Among the other communications of the session, the council cannot, on the present occasion, omit to notice those of your member, Mr. Parkes. His communication on the Evaporation of Water from Steam Boilers, (*see Journal*, vol. 1, p. 170), for which a Telford medal in silver was awarded during the preceding session, and the interesting discussions to which it gave rise, are too well known require further comment. But great as were the benefits conferred on practical science by the facts there recorded, they have been much surpassed by the subsequent labours of this author. In continuation of his subject, you received early in the session the first part of a communication on Steam Boilers, (*see Journal*, vol. 2, p. 225); and at the close of the session, the second part, treating of Steam Engines. Before Mr. Parkes was induced to turn his attention to the preparation of these communications, no attempt had been made to bring together, in one connected view, the various facts which had been ascertained. The economy of the Cornish system was indisputable; but to what it was to be referred was involved in some obscurity. It was reserved for this communication to call attention to certain quantities and relations which exerted a peculiar influence over the results; and which, being rightly ascertained, were at once indicative or exponential of the character of the boiler. If it be found that, in one class of boiler, the same quantity of coal is burnt eight times as rapidly as in another class—that the quantity consumed on each square foot of one grate is twenty-seven times that on the grate of another—that the quantity of water evaporated bears some definite relation to the quantity of heated surface—and that there is twelve times more evaporated by each foot of heated surface in one class of boiler than in another—and finally, that the quantity of water evaporated by a given weight of fuel is in one class double the quantity evaporated in another,—we have arrived at some definite relations whereby to compare boilers of different kinds with each other. To these definite quantities and relations, the author, with apparent propriety, assigns the term "exponents;" and these being compared together for different boilers, their respective merits as evaporative vessels are readily perceived. Mr. Parkes has also called the attention of engineers to the effect of the element time, that is, the period of the detention of the heat about the boiler. The importance of attending to this cannot be too strongly insisted on; as it would appear from these statements, that boilers being compared with each other, in respect of their evaporative economy, are nearly inversely as the rate of combustion. Attention is also called to the fact, that there are actions tending to the destruction of the boiler entirely independent of the temperature of the fire, and which may be designated by the term "intensity of calorific action." Of their nature we know nothing, but the durability of different boilers, under different systems of practice, affords some means of comparing the intensity of these actions.

Mr. Parkes having, in the first part of the subject, thus pointed out the distinctive features of the different classes of boilers as evaporative vessels, proceeds, in his subsequent and concluding communication, to consider the distribution and practical application of the steam in different classes of steam engines. And for this purpose, he is led to consider the best practical measure of the dynamic efficiency of steam—the methods employed to determine the power of engines—the measures of effect—the expenditure of power—the proportion of boilers to engines—the standard measure of duty—the constituent heat of steam—the locomotive engine—the blast and resistance occasioned by it—the momentum of the engine and train, as exhibiting the whole mechanical effort exerted by the steam—the relative expenditure of power for a given effect by fixed and locomotive non-condensing engines. This bare enumeration of the principal matters in the second communication will give some, though a very inadequate, idea of the magnitude of the task undertaken by Mr. Parkes, for the communication is accompanied by elaborate and extensive tables, exhibiting the results of the facts which he has collected and used in the course of his inquiry, and it may confidently be asserted that a more laborious task has rarely been undertaken or accomplished by any one individual than the series of communications thus brought before the Institution.

It will be one of the earliest duties of the succeeding council to consider in what manner the sense of the great benefits conferred on this department of practical science can most appropriately be testified.

The council also received, at the close of last session, from your member, Mr. Leslie, a most valuable communication on the Docks and Harbour of Dundee. This is one of the records on which the Institution sets the highest value, being the detailed account of an executed work of great extent. It is not, in its present form, well adapted for being laid before the meetings; but on its publication, which will take place very shortly, the Institution will have an opportunity of judging of the high value which it possesses.

In acknowledging, with gratitude, the numerous and valuable presents made to the Institution during the past year, the council would call the attention of the members generally to the want still existing in the library of works of reference on general scientific subjects not immediately connected with engineering, and express a hope that such wants may be supplied by that liberality to which the Institution is already so deeply indebted. The collection of models also requires many additions to render it as complete as the council could wish, and it is only by the wants of the Institution being constantly borne in mind by all who are interested in the subject, that such a collection can be formed as shall be worthy of the Society.

Several societies have made an exchange of Transactions with the Institution, and from the Royal Society of Edinburgh, the Philosophical Society of

Manchester, the Royal Irish Society, and the Royal Astronomical Society, sets of Transactions, as complete as could be made up, have been received. The Master-General of the Ordnance, the Lord-Lieutenant of Ireland, and Colonel Colby, continue their liberal presents of the English and Irish Surveys; and Captain Beaufort and the Secretary of the Admiralty have continued the present of the series of Admiralty Charts. The Institution is also indebted to Mr. Vignolles for the Busts of Locke and Dr. Hutton; to Mr. Field, V.P., for a Bust of the late Henry Maudslay; and to Mr. Rivers, for that of Dr. Faraday.

The council would wish to take especial notice of the large collection of works of the late eminent philosopher, Dr. Young, now deposited in your library. For this great acquisition, the Institution is indebted to the kindness and liberality of his brother, Mr. Robert Young, who conceiving most justly that every thing connected with so great a benefactor to practical science must be highly valued by this Institution, has made it the depository of these books from the library of his distinguished relative. The council, in thus publicly recording their sense of the kindness and liberality of Mr. Robert Young, would earnestly press upon others the importance of following so noble an example, and of presenting such works as are at their disposal, and of which the library of the Institution is particularly in need.

It is announced through the medium of the last Annual Report, that the monument of Telford was nearly finished, and that a site had been selected in Westminster Abbey. The council have now the satisfaction of announcing that the monument is fixed in the place destined for it, and they are confident that all who enjoyed the acquaintance, or knew the merits, of the late distinguished president of this Institution, will rejoice that the memory of one so eminent and so highly deserving has met with so proper and just a tribute of respect; whilst all, no less than those by whose liberality the monument was erected, will feel that he has a name which will endure so long as there exists a record of the triumphs of the British engineer.

It would be vain to expect that an annual meeting should ever recur without the council having to lament the removal by death of some who, by their acquirements, or by their associations of friendship, were endeared to the Institution. On the present occasion the council have to lament the death of your members, Mr. David Logan and Mr. Henry Habberley Price, and of your honorary member, Mr. Davies Gilbert. The records of the Institution contain several communications from Mr. Logan, particularly one on the new Graving Dock at Dundee, and Mr. H. H. Price was, when in town, a constant attendant at the meetings, and took a lively interest in the proceedings and success of the Institution. Mr. Davies Gilbert was, by his writings and his influence, a great benefactor of practical science, and the Transactions of the Royal Society, over which he presided for three years, contain several papers of great value to the practical engineer. He took great interest in the introduction of Mr. Watt's improvements in the steam engine into the Cornish mines, and in the controversy betwixt Mr. Watt and Mr. Jonathan Hornblower respecting working steam expansively, the former employing one cylinder only, the latter two cylinders, in the manner afterwards revived by Woolf; the theoretical efficiency of the two methods being identical, but simplicity and mechanical advantage being greatly in favour of the former, as its present universal adoption testifies. Mr. Davies Gilbert introduced into practical mechanics the term "efficiency" as the product of the applied force and of the space through which it acted in contradistinction of the term "duty," as indicative of a similar function of the work performed. His attention was also directed to the theory of suspension bridges, when the plan for making such communication across the Menai was submitted to the commissioners appointed by parliament. It appeared to him that the proposed depth of curvature of the catenary was not sufficient, and his well-known theoretical investigation of this subject was undertaken with the view of ascertaining this fact; and in consequence of these investigations, the interval between the points of support of the chains and the roadway was increased to the height which appeared to him requisite for works of this nature. The labours of this distinguished individual for the promotion of science were unremitting. He was the founder of several societies; he was the discoverer and early patron of the talents of Davy; and while in parliament he laboured most assiduously in the advancement of all the public works. Regret for such a man, exerting the power of his mind so advantageously and through so many years, must always be strong and sincere; but having attained the ordinary limit of human life, he sunk into the grave amidst the respect and esteem of all who knew him, and has left behind him a name which will ever bear a prominent place amidst the names of those whose lives and talents have been devoted to great and noble purposes.

GEOLOGICAL SOCIETY.

On the relative Ages of the Tertiary and Post-Tertiary Deposits of the Basin of the Clyde, by James Smith, Esq., of Jordan Hill.

In former communications Mr. Smith showed that deposits in the basin of the Clyde had been elevated above the level of the sea during very recent geological epochs, and that some of these beds contain testacea which indicate the prevalence, during the period of their accumulation, of a colder climate in Scotland than exists at present. In this paper he confines his remarks to subsequent observations, which afford most satisfactory evidence that these comparatively modern deposits are divisable into two distinct formations, differing in their fauna, and separated by a wide interval of time. In the older of these formations Mr. Smith has found from 10 to 15 per cent. of extinct or unknown species of testacea; but in the newer only such shells as inhabit the British seas. He accordingly places the former among the newest pliocene or pleistocene deposits of Mr. Lyell, and the latter among the post-tertiary series. Both of these accumulations, he, nevertheless, considers to be older than the human period. In the lowest part of the pleistocene formation of the basin of the Clyde, Mr. Smith places the unstratified mass of clay and boulders, locally called "till," and in the upper, which rests upon it, the beds of sand, gravel, and clay, containing marine shells, a portion of which are extinct or unknown. He is of opinion that some of the similar accumulations in the basins of the Forth and the Tay, will probably prove to be of the same age, as well as the elevated terraces of Glenroy, recently shown by Mr. Darwin to be of marine origin. He is also convinced that a very great proportion to the superficial beds of sand, gravel, and clay will be ascertained to be tertiary, although the absence of organic remains must render it difficult to obtain, on all occasions, satisfactory evidence. During the post-tertiary epoch, or while the beds containing only existing testacea were accumulated, changes of level in the basin of the Clyde must have taken place to the amount of forty feet; but during the human period no change appears to have occurred.

The paper concludes with a list of the fossil shells obtained by Mr. Smith, and not found living in the British seas, or of doubtful existence in them. The number of the species is twenty-four—six of which occur in the crag of England, three in the most recent tertiary strata of Sweden, and seven in a living state in the North seas.

On the noxious Gases emitted from the Chalk and overlying Strata in sinking Wells near London, by Dr. Mitchell.

The most abundant deleterious gas in the chalk is the carbonic acid, and it is said to occur in greater quantities in the lower than the upper division of the formation. The distribution of it, however, in that portion of the series is very unequal, it having been found to issue in considerable volumes from one stratum, while from those immediately above and beneath none was emitted. Sulphuretted hydrogen and carburetted hydrogen gases sometimes occur where the chalk is covered with sand, and London clay, as well as in other situations. In making the Thames Tunnel they have been both occasionally given out, and some inconvenience has been experienced by the workmen, but in no instance have the effects been fatal. In the districts where sulphuretted hydrogen gas occurs the discharge increases considerably after long-continued rain, the water forcing it out from the cavities in which it had accumulated. The paper contained several cases of well-diggers having been suffocated from not using proper precautions.

The tables of the Meeting-room and the Library were covered with donations of specimens and books.

WEDNESDAY, NOVEMBER 20.

Four communications were read.

An extract from a letter addressed to Dr. Andrew Smith by Mr. A. G. Bain, dated Graham Town, Cape of Good Hope, Feb. 21st, 1839, announcing the discovery of the skull and piths of the horns of an ox in an alluvial deposit on the banks of the Modder, one of the tributaries of the Orange River, and forty feet below the surface of the ground. The piths measured, in the direction of their curvature, and including the breadth of the os frontis, eleven feet seven inches, but it is calculated that about five inches had been broken off each point. Their circumference at the root was eighteen inches, and the orbits are described as situated immediately under the base of the horn. Other portions of the head, and five molar teeth, were found at the same time.

On the Origin of the Vegetation of our Coal-Fields and Wealdens, by J. T. Barber Beaumont, Esq.

The author of the communication is of opinion, that the plants discovered in the coal measures were not drifted into large estuaries and there sunk, but that they grew where they are found, and that the districts now forming our coal-fields were originally islands. The principal objections advanced in the paper, against the theory of the transportation of the plants by great rivers, are, that such bodies of water would have required for their existence extensive continents, of which there are no traces; that, as the coal strata near Newcastle are 380 yards in thickness, the depth of the estuary must, in that case, have exceeded six times the mean depth of the German Ocean; that the formation surrounding the coal-fields are of marine origin, and bear no traces of having been dry land at the same time the coal and its associated strata were accumulated; and that the freshness of the plants is opposed to the view of their having been drifted from a distance, and sunk in a deep estuary —a process which must have been accompanied by a certain extent of decay in the plants. Mr. Beaumont then briefly proposes the following, as a preferable theory to account for the production of the coal-fields:—He supposes that they were originally swampy islands, on which plants flourished, and in part decayed; that the islands, during the settling of the earth's crust, were submerged, and covered with drifted clay, sand, and shells, which buried the plants; that these accumulations gradually raised the surface of sunken islands till it again became dry land, and adapted for the growth of another series of plants; and that these processes were repeated as often as there are alternations of coal and strata of earthy sediment.

On the Fossil Fishes of the Yorkshire and Lancashire Coal-Fields, by Mr. W. C. Williamson.

Within the last four years the coal measures of these countries have assumed a zoological importance. which previously they were not supposed to possess. In Lancashire icthyolites have been lately found to pervade the whole of the series from the Ardwick limestone to the millstone grit, and in Yorkshire they have also been obtained in great abundance. On comparing the specimens procured at Middleton colliery, near Leeds, with the fossil fishes of Lancashire, the author detected the following as common to both coal-fields, viz.:—*Diplodus gibbosus, Ctenoptychus pectinatus, Megalicthys, Hibbertii, Gyracanthus formosus;* also, remains of apparently species of Holoptychus and Platysomus; but he has obtained some icthyolites in the Yorkshire field which he has not seen in the Lancashire, and he is of opinion that the latter deposits are characterised by the greater prevalence of lepidoid fishes, and the former by sauroid. These remains, except in the case of the Ardwick limestone, always occur in highly bituminous shale, and they are most abundant where it is finely grained, and in general where plants are least numerous. This distinction in the relative abundance of icthyolites and vegetables, Mr. Williamson conceives may throw some additional light upon the circumstances under which the coal formations were accumulated. The fishes are found chiefly in the roof of the coal, rarely in the seam itself, and not often in its floor. Mr. Williamson, in conclusion, makes some remarks on the manner in which icthyolites are associated with the other fossils of the coal measures. At Burdiehouse they occur in the midst of freshwater shells and Cypris; at Coalbrook Dale with marine testacea; in the lower coal measure of Lancashire, not far from the beds containing *Goniatites Listeri*, and *Pecten papyraceus;* higher in the same field, and in Yorkshire, they are associated with freshwater shells; at Middleton with Lingulæ; and at the top of the series in Lancashire and Derbyshire with Mytili and Melaniæ.

A paper on the Geology around the Shores of Waterford Haven, by T. Austin, Esq.

As the object of this communication is to describe topographically the structure of the shores of Waterford Haven, its details do not admit of abridgment. The formation composing the district are mountain limestone, a conglomerate, clay-slate, and trap, the limestone and conglomerate constituting the greater portion of the east side of the Haven, and the conglomerate the opposite.

REVIEWS.

On Steam-Boilers and Steam-Engines. By Josiah Parkes. Transactions of the Institution of Civil Engineers, vol 3. London: J. Weale. 1840.

PART II.—ON STEAM-ENGINES, PRINCIPALLY WITH REFERENCE TO THEIR CONSUMPTION OF STEAM AND FUEL.

In our Number for July last we noticed the part of this investigation, which treated of the qualities of steam-boilers, and of the influence exercised over evaporation by their proportions and practical management. Of that part we considered the only value to consist in the *facts* therein recorded.

In the introduction to this part the author makes the following very sensible observation:

"The generation and application of steam are distinct problems; they require to be separately treated, and their results to be separately stated. It is the economy of steam which constitutes the dynamic perfection of an engine; it is the economy of heat in supplying steam to an engine; which constitutes the evaporative perfection of a boiler; and it is only by distinguishing the effects of each, that the value of any change of practice, in either department, can be correctly ascertained."

Now, although there may be few, if any practical engineers, who would be disposed to doubt the truth of this remark, yet we are persuaded that it is not in general duly appreciated, or at least, that very little attention is paid to it by them.

The author has divided this part into two portions: in the first, which occupies about one-fourth of the whole, he has investigated the atmospheric, the stationary non-condensing, or the high-pressure, the low-pressure condensing, and the Cornish high-pressure expansive pumping engines. The facts established on these four varieties are collected and exhibited in a comprehensive table, (table 6.) The last three-fourths of the work are dedicated solely to the locomotive engine, the chief part tending to prove the inaccuracy of all the estimations which have hitherto been made of the several resistances which have to be overcome by that variety of engine. The author has, however, also developed a *new theory of the locomotive engine*, the fallacy of which will be at once evident to the scientific reader; but its plausibility might induce the practical man (who has not the means of detecting theoretical errors,) to put implicit faith in its correctness. For his sake, therefore, we shall feel it necessary to take more notice of this new theory than we should otherwise have done.

The two sections in which the author treats *of the methods employed to determine the power of engines*, and *of the measures of effect*, present nothing worthy of notice; but in the next section, which treats *of the expenditure of power*, we have to point out an error, which we thought to be already so thoroughly eradicated, that it could never more find its way into any work having the slightest pretensions to science. This section commences thus:

"The ponderable element of steam is water; its consumption by an engine is appreciable; and it is now assumed, almost universally, that the sum of its imponderable element, heat, is a constant quantity, in steam of all specific gravities. The elastic force of steam is also generally assumed to be proportional to its density; thus, equal amounts of heat and water are expended in the generation of equal power, at whatever pressure steam be used by an engine."

We admit the first assumption, that the quantity of heat contained in a given weight of steam is a constant quantity, whatever may be its density; but it is not a fact, as Mr. Parkes assests, that the elastic force of steam is also generally assumed to be proportional to its density: indeed a comparison of the numbers given in the table, (page 122,) which he himself took from M. de Pambour's *New Theory of the Steam Engine*, would have convinced him at once that that assertion was not well founded. For we there find the volume of steam formed from a volume of water equal to unity is equal to 2427, when generated under a pressure of 10lbs. on the square inch; and 677, when generated under a pressure of 40lb. We ought, therefore, to have, since these volume are inversely proportional to the density of the steam,

$$10 : 40 :: 677 : 2427,$$

which would give, by making the product of the means equal to that of the extremes,

$$24270 = 27080,$$

which is absurd. The conclusion drawn from this law is therefore also false; wherefore equal amounts of heat and water are *not* expended in the generation of equal power, when the steam is used at different pressures.

In this same section, (page 55,) the author tells us that

"By knowing the evaporation from the boilers, and consequently, the weight of water as steam which passes through an engine, we grasp the principal fact of practical consequence to the engineer; a fact which is free from all uncertainty in its nature; . . . . and the weight of water, which has passed from the boiler in that state, and produced a given effect, appeals conclusively to the understanding as indicative, in a comparison of engines, of their respective economy in the expenditure of power."

This does not seem very consistent with what he says on the subject in the first section, (page 52,) where, speaking of this method of determining the power of engines, he observes, that "as its value depends on a perfect accordance between the results of experimental and practical science—an accordance yet unascertained,—and since many precautions are requisite to secure true results from this test, it has been seldom resorted to by practical men."

The discordance between these two quotations is most remarkable, and the paragraph which follows the latter leaves no room to doubt that the basis of the method there alluded to is the identical fact which he says is *free from all uncertainty in its nature*, &c.

In the table already alluded to, (table 6,) will be found many results computed from the data furnished by experiment, which, if correct, will be of great practical utility to the engineer. Among these may be mentioned the weight of water as steam equivalent to the production of a horse power in each engine, and also, the duty effected by one pound of steam. "These sums, (columns 11 and 16,") the author observes denote the positive and relative *efficiency of steam* in the different "engines;" and here we recognize the pen of Mr. Parkes in the signification he gives to the word *relative*, it being here used to express the *inverse* of positive. Thus the *relative* efficiency of the steam *decreases* in precisely the same ratio as its *positive* efficiency *increases*, which we find difficult to comprehend with our preconceived notions of the meaning of the word *relative*. We should have thought, for instance, that if the *positive* efficiency of the steam in a given engine were equal to a, and in a second engine to b, its *relative* efficiency in the first in comparison with the second would be $\frac{a}{b}$, and that if, the positive efficiency b, remaining the same, that if the engine were increased from a to $2\,a$, its *relative* efficiency would also, be increased from $\frac{a}{b}$ to $\frac{2a}{b}$, or in the same ratio as its *positive* efficiency, The true *relative efficiency* both of the steam and of the fuel is however, given in columns 21 and 22, under the head *Comparative economical results.*

The next section, which treats *of the proportion of boilers to engines*, in our opinion serves rather to confuse and perplex the reader, and to deprive him of confidence in the numbers set down in the table, than to render him any assistance in drawing practical conclusions from them. We had intended to make a few observations on particular parts of this section; but having vainly endeavoured to follow the intricate reasoning of the second phragraph, and finding nothing of any importance in the rest, we shall merely direct attention to column 20, which will appear on the slightest examination to throw no light whatever on the economical qualities of either boilers or engines.

In the *observations on the experiments and their results*, which follow this section, there is nothing worthy of notice before the 61st page, from which we quote the following paragraph, in order to shew how necessary it is to sift *with the utmost care* all the results tabulated in this work.

> "It is necessary, also, to guard against conclusions which might be deduced, from a comparison of the effects of the Cornish engines in the table, with the pressures on the piston and degrees of expansion, set down in columns 5 and 6. The pressures given were not ascertained by any instrument, (excepting at Huel Towan,) and must be considered only as estimations, not as facts. The pressure upon the piston during the interval which occurs between the first admission of steam into the cylinder, and the instant of shutting it off, may be very variable; that it was so, in several engines to which Mr. Henwood applied the indicator, is evident from the diagrams he has given, annexed to his paper. (Trans. Inst. C. E. Vol. II.) At the Huel Towan engine, when the steam in the boilers was at a pressure of 47·1 lbs. above the atmosphere, it varied from 12·3 lbs. to 7·3 lbs. per square inch on the piston, during its admission into the cylinder; which latter was its elastic force, at the instant of closing the steam-valve. I adduce these facts, with the view of showing the impossibility of determining the precise amount of prssure on the piston, from the degree of *wire-drawing* the steam; and as a caution against expectations of deducing any valid theory of the action of the steam, in these Cornish engines, from the particulars of pressure and expansion, contained in the table, which are only approximations to the truth."

Mr. Parkes does not seem to have compared the numbers contained columns 6 and 14, otherwise he never could have considered the above caution necessary; for the anomalies which would be found to result from the adoption of the numbers there set down are so striking that it would soon be discovered that either the pressure of steam on the piston, or the consumption of water as steam is incorrectly given; and it would certainly not occur to any one to deduce any theory of the action of the steam from such conflicting data. A superficial examination of experiments 7 and 9 will give an idea of the confidence which can be placed in the numbers contained in the table.

The diameters of the cylinders of these two engines are equal, but the latter has four inches greater length of stroke; the steam is also admitted into the cylinder of the latter during one-fourth of the stroke, while in the former it is cut off at one-fifth; but, since the latter only makes 4·29 strokes per minute, while the former makes 5·35, the volume of steam consumed in an hour should have been about equal in the two experiments. Now the pressure of the steam before the expansion is given as 7·3 lbs. per square inch in the former case, and 27 lbs. in the latter case, above the atmosphere, and the volume of steam generated from a given volume of water under these two pressures is respectively proportioned to the numbers 1173 and 653; the consumption of water as steam must therefore be nearly inversely as these two numbers, and taking the consumption per hour in the former experiment at 2156·21 lbs., as in the table, the consumption in the latter experiment ought to be about 3873·25 lbs., whereas it is given in the table as only 972·62, or very little more than one-fourth part of what it ought to be. We conclude from this that the numbers set down in column 6 are of no value whatever, as they do not appear to represent the true pressure on the pistons: nor indeed is it probable that the steam should lose so much as 42 lbs. of its pressure in passing from the boiler to the cylinder, as in the case of the Huel Towan engine, experiment 7. (See columns 6 and 7.) If *wire-drawing* is really carried to such an extent in the Cornish engines, it is a proof of sad mismanagement; for, if it is necessary to throttle the steam to such a degree, in order to reduce it to the desired pressure in the cylinder, it is very evident that the load on the safety-valve might be diminished, and the steam thus generated at a lower temperature, the advantages of which are too obvious to need pointing out here.

Mr. Parkes does not seem very confident of the advantage of the Cornish (expansive) system of using steam in manufacturing engines requiring uniformity of motion, and seems to approve of the method recommended by Mr. Wicksteed in such cases,—(see the Journal for January,) namely to employ a Cornish engine to raise water up on a wheel, and thus transfer its power to machinery. Now, although the momentum of such machinery is but trifling, an equivalent is easily found in a fly-wheel, and the want of uniformity in the action of the steam is probably not so great as may be supposed.

We agree with the author that the *pound of water as steam* consumed by an engine is the most convenient and correct standard of duty which can be adopted, provided we know the true quantity of water which passes through the engine in the form of steam.

The first division of this work is concluded with a chapter *on the Constituent Heat of Steam*, in which the author describes a series of experiments made by himself, the results of which confirm the already generally admitted law, that equal weights of water absorb equal quantities of heat in passing from the liquid to the elastic form, under all pressures.

The remaining portion of this work, which treats *of the Locomotive Engine*, being very long and perplexing, we have not sufficient leisure to enter into a detailed examination of all the difficulties and doubts, opinions and arguments contained in it; we must, therefore, content ourselves with a few general remarks.

The greater part is occupied by an examination of the experiments of M. de Pambour, Mr. Robert Stephenson, Mr. Nicholas Wood, and Dr. Lardner; the object of this examinution being apparently to convince the reader of the inaccuraey of *some of the results* of experiment, and of *all the deductions* hitherto drawn from them, and to prepare him for the reception of a *new theory* of his own, which he lays down in a separate section near the end of the work.

It is very certain that the experiments hitherto made on locomotives are too few in number, and too imperfect in their nature to allow of any certain theory of their action being as yet deduced from them; but on the other hand we have no doubt that a careful investigation of Mr. Parkes' objections would bring many fallacies to light, which might otherwise have the effect of unjustly shaking our confidence in the results previously obtained and published by other authors. As an instance we shall merely cite the comparison he has instituted between two of M. de Pambour's experiments, (pages 95 and following,) which were made with the same engine (Atlas) at two different speeds, and with corresponding loads. Mr. Parkes, in his detailed calculation of the effects produced in these two cases, omits, without assigning any reason for so doing, to include the pressure on the back of the piston, which is undoubtedly a part of the resistance, and therefore the power expended in moving this resistance at the velocity of the piston, is a part of the gross power of the engine, or of the total effect of the steam. With this omission Mr. Parkes finds the absolute (or gross) power of the steam equal to 67·11 horse power in the first case, where the velocity was 20·34 miles an hour, and 59·50 in the second, where the velocity was 27·09, (See page 95.)

In these two experiments M. de Pambour gives the same effective evaporation, namely, ·77 of a cubic foot of water per minute; and it is to prove the impossibility of this fact that Mr. Parkes made the above comparison; for he observes (page 99); "To be consistent, however, with his own (M. de Pambour's) rule above quoted, viz. that 'the weights of water consumed as steam are to each other as the resistances against the piston,' it is obvious that if, in the first case, 3026 lbs. of steam passed through the cylinders in an hour, 2166 lb. only would have been expended in the second case." Now this assertion is not even justified by his own calculations, for M. de Pambour evidently did not, nor could he mean to say that the weight uf steam which passes through the cylinder in a given time is proportional to the resistance, whatever may be the speed of the engine, which would obviously be absurd, but that the density of the steam, and therefore the weight which passes through the cylinder in a given number of strokes, or which is the same thing, in travelling over a given distance, is proportional to the resistance. The consumption of water in a given time would thus be directly as the product of the resistance by the velocity, or the gross power of the engine; so that, if this power is equal in the two cases, so ought also the evaporation perminute.

The effect of the steam in overcoming the resistance of the atmosphere on the opposite side of the piston is equal to 25·25 horse power in the first case, and to 36·77 in the second, which, added to 67·11 and 59·50, found by Mr. Parkes, respectively give 92·36 and 96·27 horse power as the gross effect of the steam in the two cases. The near coincidence of these two numbers shews that in this case at least there is no validity in Mr. Parkes' objections. We should therefore recommend a most diligent and patient examination of this section, before the adoption of any opinion therein expressed, or the rejection of any others previously entertained,

We have already alluded to a *new theory of the locomotive engine* proposed by the author of this work: the section in which he explains this theory commences (page 124) thus:

"OF MOMENTUM AS A MEASURE OF THE EFFECT OF LOCOMOTIVE ENGINES.

"The effective power of a locomotive engine—by which is meant the excess of power after overcoming its proper friction, and the resistance from the blast—is solely expended in the generation of momentum. The momentum communicated to the entire mass set in motion represents the useful mechanical effort exerted by the steam; this effect of the engine is, therefore, at all times determinable; for, being the simple product of the mass moved, multiplied into its velocity, it is the product of two quantities easily ascestained under all the practical circumstances of railway traffic. The consumption of power, as water in the shape of steam, is a third quantity also readily appreciable.

"Were it possible to work a locomotive engine and its train *in vacuo*, on a truly level plane, the momentum generated by an equal expenditure of power would be a constant quantity at all velocities; for, the resistance being invariable, equal momenta would be produced by an equal expenditure of power with all loads, as the velocity attained would be in the inverse ratio of the loads, and vice versâ. This hypothetical case supposes friction and resistance of all kinds to be constant."

This is not only a *new theory* of the locomotive engine, but one which involves a *new definition* of the word *momentum;* for, according to the present acceptation of the term, momentum can only be *generated* during an acceleration of the moving mass, which accelleration is not, and ought not to be considered in locomotives, unless the time in which a given accession of velocity is also taken into account at the same time, which is evidently not contemplated by Mr Parkes. What is here understood by the *momentum generated* in one second, is nothing but the *absolute momentum* referred to the second, as the unity of time, which is deduced from the *uniform velocity* of the engine, without reference to the time in which it acquired that velocity.

Since the resistance does not enter into this expression of the power of the engine, it would follow that the same engine would draw the same train at the same velocity, whatever the nature of the road may be; since the evaporation being the same, the power expended must be the same; and since the mass moved is the same, so must also its velocity, to make its momentum equal. The absurdity of this doctrine is obvious.

The next section contains some good observations on *the blast*, as well as some experiments made by the author on *the resistance produced by it;* but no reliance can be placed in the results there recorded, some of them being evidently impossible. At page 147 we read the following:

"The immediate cause of my entering on these experiments is worth mentioning. I one day observed the mechanic in care of the machine, whilst preparing for work, opening and shutting the grease cocks of a cylinder, and giving oil to a piston. The engines were then working without load, and it was evident that a small vacuum existed after the blast, or the oil would have been blown back instead of entering the cylinder. This fact, the possibility of which had not before struck me, induced me forthwith to order another gauge from Mr. Adie, which was fixed on one of the blast-pipes, in a convenient place for constant observation, about 2½ feet from its junction with the cylinder, the bulb being exposed to the full current of the escaping steam. This instrument detected the fact of a vacuum by marking, usually, a temperature of from 208° to 210°, or about 1 lb. per square inch below the atmospheric pressure, the active steam on the piston being 1½ lb. above it. When the engine was driven at double velocity, or at 120 revolutions per minute, at which speed it required about 3½ lbs. of steam, the thermometer rose to 211°, and when locomotion was given to the machine at the usual velocity of 60 revolutions of the crank shaft, and requiring 4 lbs. in the boiler, the blast thermometer stood at 212°, exhibiting a pressure equal to the atmosphere only. At 8 lbs. on the piston, a counter pressure of about 2 lbs. was exhibited, at 15 lbs., about 4 lbs., and at 20 lbs. the blast thermometer indicated 6 lbs., beyond which point I was unable to load the engines."

In his observations on M. de Pambour's experiments (page 87), Mr. Parkes justly remarked that a *vacuum* on the opposite side of the piston was *an impossible result*, and this remark evidently holds good for his own experiments as well as his deduction from those of M. de Pambour.

In conclusion, we would again caution our readers against adopting the conclusions arrived at by by Mr. Parkes without first submitting the whole of his work to the strictest scrutiny. There is some, and there may be much good in it; but, having detected errors of importance in some parts, we cannot depend on the correctness of that which we have not had time to inquire into.

Very great merit is however due to Mr. Parkes for the indefatigable zeal he has exhibited in the compilation of data, and in the comparison of results therefrom deduced, which must have cost him much time and labour, with the praiseworthy object of advancing our yet imperfect knowledge of the effects and comparative economy of steam engines.

THE ROYAL LODGES IN WINDSOR GREAT PARK, *from Drawings by* H. B. ZIEGLER, *executed by* L. HAGHE, *in lithography, by express command, for Her Gracious Majesty Queen Victoria.* Folio. Ackermann.

If by "express command" we are to understand more than a mere permission, all we can say is that we cannot possibly compliment "Her Gracious Majesty" upon her taste, for while considered as drawings, the plates are far from rivalling preceding specimens of lithography, as architectural subjects they are very much more unsatisfactory. Indeed it seems to have been taken for granted that the less that was said about these buildings the better, there being no description or information of any sort attached to the plates: therefore, not happening to be acquainted with their history, we are unable to say who was the perpetrator of these Cockney whims and monstrosities—tasteless jumbles of cottage, castle, and what not, without a single redeeming merit of any kind, downright paltriness, and utter want of feeling for any one of the styles thus attempted, being their chief characteristics.

Scarcely can we bring ourselves to believe that Sir Jeffry Wyatville was concerned in the erection of this architectural trumpery; and if not, he would do well to clear himself from a suspicion which is very likely to attach itself to him, as the Royal architect at Windsor. Let the designs have been by whomever they may, they ought never to have been executed; and it fills us with concern to behold—emanating from what ought to be the fountain head of taste, such specimens of it as would be excusable only in some suburban tea-garden. But for their feebleness they might pass for arrant caricatures.

Arboretum et Fruticetum Britannicum; or, the Trees and Shrubs of England. By J. C. LOUDON, F.L. and H.S., &c. London: Longman and Co., 1839, 8 vols. 8vo.

THE name of Mr. Loudon suggests the idea of a work of great extent, of great labour and research, but that now before us surpasses any of his previous triumphs. It bears less the impress of an individual production than of a national work, a character sustained by the number and value of its contributors, and by the eagerness with which all ranks devoted themselves to the promotion of a task so noble. The man of science hastened to contribute from his stores of knowledge, the grandee and the gentleman threw open their rich collections, or volunteered at their own expence to obtain illustrations for the work. From the duke downwards every patron and amateur of horticultural science seems to have considered co-operation in the work a duty and a pleasure. This detracts not from the value of Mr. Loudon's labours, it enhances them, and is a high proof of the estimation in which they are held.

This work, as it professes, gives a pictorial and botanical delineation, and scientific and popular description of the native and foreign, hardy and half-hardy trees and shrubs of England, with their propagation, culture and management, and their application in landscape gardening. To the landscape artist trees have the same importance as details of style have to the architect, and every artist and amateur is, consequently under an obligation to possess himself of this encyclopædia of the art. The letter-press in the old times might legitimately have been spun out to twenty volumes; the engravings our fathers could never have compassed, they are two thousand five hundred in number, and are executed from drawings by the Sowerbys, and other botanists of distinction. We have only one fault to find with the work, and that is, that we see it disfigured with a barbarous Latin name.

To give extracts from these volumes would be indeed to realize the old Greek apophthegm of showing a brick for a house, so that we must content ourselves with expressing our feeling of the value of Mr. Loudon's labours, and with recommending this admirable work to all who wish to follow with success an art so grand, as that of landscape gardening.

Elementary Principles of Carpentry, illustrated by 50 engravings and several wood-cuts. By THOMAS TREDGOLD. Third edition, with an Appendix, by PETER BARLOW, F.R.S. London: John Weale, 1840.

THIS is a new and improved edition of Tredgold's work, and Mr. Barlow bases his chief claim for its value as much on the proper retention of the original matter, as on the excellent additions which he has appended to it. These accessions are so important as to make the new edition desirable even to those who possess the work in its original form. Among many excellent specimens of Foreign and English roofing now introduced from the highest sources, may be particularly mentioned the information given relative to that admirable work King's College Chapel, drawn by Mackenzie, and St. Dunstan's Church, Fleet-street, by Shaw. The drawings of the iron roofs executed by the Butterley Iron Works Company are no less interesting, as well as those of several new buildings in London. We do not, however, so much admire the roof of the Exchange at Genoa, it strikes us as showing more ingenuity than science. We shall probably notice this work more at large next month.

An Essay on the Formation of Harbours of Refuge and the Improvement of the Navigation of Rivers, by the adoption of Moored Floating Constructions as Breakwaters. By JOHN WHITE, Architect, London.

Mr. White has long been an advocate for the application of floating breakwaters, and we think that he appeals successfully to his readers, considering that their own experience on any common river must have convinced them of the efficacy of such a mode of protection. With the application of Mitchell's Mooring Screw and the new Wire Cable, we see no difficulty in carrying out Mr. White's plans both efficiently and successfully.

We feel indebted to the author for the tribute he has paid to our exertions and those of our correspondents, in promoting such an important branch of engineering as harbour construction, but no feeling arising from this tribute, influences us in the expression of our sentiments of the high value of this work.

THE RIVER BOURN, OR INTERMITTING SPRING OF THE NORTH DOWNS.

THE bursting or breaking out of the Bourn water about two months since excited some attention at the time, on account of the interval elapsed since its last eruption in the early part of 1837, being shorter than usual, but now (Feb. 16,) that the waters have continued to flow with increased volume, and having flooded the valley through which it passes, together with the lower part of Croydon, called the Old Town, and the turnpike road, it has become a serious inconvenience. This intermitting spring is situated in the great chalk range which stretches in an east and west direction through the south-east of England, called the North Downs, in distinction from the parallel chalk range near Lewes and Brighton, called the South Downs. A traveller taking the high road from London through Croydon to East Grinsted and Lewes, would pass along the valley through which the Bourn water runs. A little to the south of Croydon, the chalk rises from beneath the London and plastic clay formations (its dip being northwards), and with comparatively slight undulations, it attains the height of 800 feet above high water level, within a distance of eight miles to the south of Croydon, the summit being 667 feet above that town.

The first appearance of the Bourn water is in a flat part of the above valley, just below Birch wood house, and is situated between the Half Moon Inn at Catterham Bottom, and the Inner entrance to Marden Park, where it bubbles through the surface of the ground in an almost infinite number of jets, some of them are extremely small, and none more than a quarter of an inch diameter; about twenty yards from the highest of these jets their number is sufficient to form a rivulet, and in 100 yards a very considerable stream, and where it reaches Catterham Bottom, about three quarters of a mile, it may be called a river; the height of the first outburst is 350 feet above high water, from thence it flows northward to Croydon, where it is 133 feet above the same level, therefore its descent from the source to Croydon, is 217 feet in a distance of six miles, or an average of 36 feet per mile, consequently its current is very rapid. Its present eruption has been much greater than any that can be remembered by the oldest inhabitants of the district. The writer witnessed that in 1837, it was confined to the channel which from time immemorial was prepared for it, and which at Riddlesdown (about half way between its source and Croydon,) is about 6 feet wide and 5 feet deep, commonly called the dry river, from its being free from water so long; in the present instance the water has exceeded these limits, and covered the whole of the valley in many places three and four feet deep, and where it crosses Smithern bottom, it has stopped the works of the Brighton railway, that being the point where a deviation of the present Godstone road is to be made, and a bridge erected to carry the railway over the deviated road; the materials for the bridge are all upon the ground, and the embankment, which is to reach to the bridge, is brought nearly as far as it can with propriety before its erection, consequently, these works are stopped till the Bourn ceases to flow.

The cause of this curious phenomenon is, no doubt, the same as described in philosophical works under the head of intermitting or reciprocating springs, from which it appears that the water which falls upon the surface of the ground, percolates through the various strata, until it is stopped by one which is impervious, or it falls into cavities where it is collected as in a reservoir; this continues until the waters have accumulated to the filling of the reservoir, when it finds an outlet in the form of a syphon, consequently, it will continue to flow till the reservoir is empty. It would therefore appear that the short interval since the last eruption of the Bourn, has been occasioned by the almost unprecedented quantity of rain which has continued to fall for many months past.

Connected with this subject, there is a mine about three miles to the south of the source of the Bourn, in which water began to collect last autumn, and the miners were driven thereby from several of their headings in September last, and it appears that such circumstance always precedes the bursting of the Bourne, and the workmen confidently predict that event.

The works in the Merstham tunnel on the Brighton railway, which is being made through the same chalk range, and scarcely four miles west of the Bourn, have been much retarded, and now nearly suspended, by the quantity of water which has come in upon them: what few men are able to reach their works, are at the present time floated upon rafts from the shafts to the top headings, which alone they are able to drive; previous to this outburst, the tunnel was perfectly dry, and it may therefore be attributed to the same cause as the Bourn water itself.

PROGRESS OF RAILWAYS.

Greenwich Railway.—Thursday morning, 30th January, at half-past ten o'clock, a serious accident, and one that might have been attended with the most fatal results, occurred on the Greenwich Railway. Two Greenwich trains were coming up to town,—the first being the ordinary passenger train, the second one engaged to bring up a detachment of the Royal Artillery to the Tower. A Croydon train was coming at the same time from London, but before it could turn off to take the line that branches off to Croydon, it came into collision with the Greenwich passenger train, and the train with the artillerymen coming up almost immediately, the three trains got jammed together. The Greenwich train was thrown off the line, and several of the passengers injured, but none fatally. Major Boyce, of the Artillery, was severely cut about the head and face, as was a gentleman belonging to the Admiralty.—*Morning Post.*

Great Western Railway.—It is understood a single line of rails on the Great Western Railway from Reading to Twyford will be opened as soon as possible, so that the traffic by single trains should commence at a very early period. To accomplish this end, the works are proceeding day and night whenever the weather permits, but the rain has been a frequent impediment to the workmen.—*Wiltshire Independent.*

Manchester and Leeds Railway.—The Directors have just made their monthly inspection of the works, which are progressing most rapidly. Some idea of the exertions used to push forward the undertaking, may be formed from the fact that Mr. John Stephenson, the contractor for the great tunnel, which is far advanced towards completion, has now in full operation, on that contract alone, 1,253 men, 54 horses, and 14 steam-engines; and that the daily consumption of bricks is from 51,000 to 60,000.—*Railway Times.*

Progress of the North Midland Railway.—A considerable portion of this railway is so far completed as to allow of the permanent way being laid; this is done on the greater part of the line. The most forward district is that situated between Derby and Barnsley. One line of rails is now nearly all laid for the whole distance, which is about 50 miles: great exertions having been made to accomplish this, as it is expected the directors will pass along the line with a locomotive engine, between the towns of Derby and Barnsley, very shortly —probably next week. In the neighbourhood of Belper, Clay Cross, Staveley, &c., the works are proceeding night and day, in order to have a road through the large excavations in those districts. The first class stations are nearly all contracted for, and several of them are in a forward state. The Eckington one is nearly ready for the roof; the Chesterfield and Southwingfield stations are also far advanced; the Leeds and Sheffield stations have been set out during the week. The latter one is contracted for by Mr. Crawshaw, and will be situated near the entrance of the Sheffield and Rotherham Railway. It will be a large and convenient station; the cost is estimated at about 8000*l.* —*Sheffield Iris.*

South Western Railway.—A completely new town is in the course of formation between the old corporation of Kingston-upon-Thames (Surrey) and the South Western Railway, and already nearly two hundred beautiful houses, snug and aristocratic villas are finished, or in the course of finishing. From an inspection of the plans, and a view of what has been done, great taste and judgment appear to be exhibited; and the railway Company, from the advantages of its site over that of the old Kingston station, have been induced to remove it to the entrance to the new town, where a very commodious structure has been erected for the accommodation of the public. It is a singular fact, and one which must mainly contribute to the eligibility of New Kingston, that the first-floor windows of the houses command a view scarcely to be equalled in England, comprising no less than five Royal Parks—those of Hampton, Bushy, Richmond, Windsor, and Claremont, besides the gardens of Kew and the river Thames; and yet this spot, by railroad conveyance is only twenty minutes ride.—*Observer.*

STEAM NAVIGATION.

Launch of an Iron War Steamer.—On Thursday, February 6th, was launched from Messrs. Ditchburn and Mare's building yard, Blackwall, the *Proserpine*, wrought iron steam vessel of 470 tons. She has four sliding keels, nine water-tight bulkheads, two of which are longitudinal running the entire length of the engine room—is armed with four long guns on non-recoil carriages, and will not exceed four feet draught of water when fully equipt for sea. The engines are two 45 horse, having the wheels to disconnect on a new and improved method to facilitate sailing, by Messrs. Maudsley, Son and Field. This vessel is constructed for sailing as well as steaming. It is a fact worthy of record, and ought to be generally known, that Messrs. Ditchburn and Mare were the first who arrived at the hitherto deemed unattainable result of giving highly superior sailing qualities to iron sea-going vessels of shallow draught of water. Their application and improvement of *sliding* *keels* have been most successful, their simplicity is such that a boy can manage them. Every person conversant with the history of naval architecture is aware that Captain Shanks, R.N. was the ingenious inventor, and that he received his first idea of them from the Indian navigating his raft, but although Captain Shanks, aided by the government of his day, made several attempts to establish their use in timber-built vessels failed, chiefly in consequence of the great difficulty in making the well and aperture through the keel, through which the sliding keel works, permanently water-tight; this in an iron vessel can be most perfectly accomplished. They are of the highest utility in the prevention of lee-way, counteracting rolling motion, and the vessel can be steered by them without the help of the rudder!

Testing the strength of Iron Boats.—On Monday, February 24th as they were lifting from the wharf a 25 horse boiler of an iron boat, built by Ditchburn and Mare, the crane which was of cast-iron broke, when the boiler and crane fell a distance of 8 feet into the bottom of the vessel, little or no damage was done, and fortunately no one was hurt. This vessel is named the *Lee*, and has the reefing wheels after Mr. Hall's patent, we believe this to be the first application of them—we wish them every success.

The *Orwell* iron steamer, plying between London and Ipswich, made during the late gales several passages from London to Ipswich in seven hours, including the calling off Gravesend, at Harwich, and other stoppages, a distance of 112 miles.

The Sons of the Thames, of which vessel we made mention in our January Journal, came from Gravesend Pier to Blackwall in one hour and five minutes, a distance of 20 miles.

LIST OF NEW PATENTS.

GRANTED IN ENGLAND FROM 30TH JANUARY, TO 26TH FEBRUARY, 1840.

Moses Poole, of Lincoln's Inn, Gentleman, for "*improvements in pumps for raising and forcing water and other fluids.*" Communicated by a foreigner residing abroad.—Sealed January 30; six months for enrolment.

William Brochedon, of Queen's Square, Middlesex, Esq., for "*improvements in the means of retaining fluids in bottles, decanters, and other vessels.*" January 31; six months.

Philippe Marie Moindron, of Bedford Place, Russell Square, Merchant, for "*improvements in the construction of furnaces and in boilers.*" Communicated by a foreigner residing abroad.—January 31; six months.

William Cubitt, of Gray's Inn Road, Builder, for "*an improvement or improvements in roofing.*"—January 31; six months.

Crofton William Moat, of Thistle Grove, Brompton, Esquire, for "*a new and improved method of applying steam-power to carriages on ordinary roads.*"—February 5; six months.

Wilkinson Steele and Patrick Sanderson Steele, Manufacturing Ironmongers, of George Street, Edinburgh, for "*improvements in kitchen ranges for culinary purposes and apparatus for raising the temperature of water for baths and other uses.*"—February 5; six months.

William Isaac Cookson, of Newcastle-upon-Tyne, Esquire, for "*certain improved processes or operations for obtaining copper ond other metals from metallic ores.*"—February 5; six months.

Thomas Myerscough, of Little Bolton, and William Sykes, of Manchester, Machine Maker, for "*certain improvements in the construction of looms for weaving or producing a new or improved manufacture of fabrics, and also in the arrangement of machinery to produce other descriptions of woven goods or fabrics.*"—February 5; six months.

Samuel Carson, of Caroline Street, Coleshill, Eaton Square, Gentleman, for "*improvements in apparatus for withdrawing air or vapours.*"—February 5; six months.

Joseph Needham Tayler, of Plymouth, Captain in the Royal Navy, for "*improvements in steam-boats and vessels making applicable the power of the steam-engine to new and useful purposes of navigation.*"—February 8; six months.

John Wertheimer, of West Street, Finsbury Circus, Printer, for "*certain improvements in preserving animal and vegetable substances and liquids.*" Communicated by a foreigner residing abroad.—February 8; six months.

Robert Beart, of Godmanchester, Miller, for "*improvements in apparatus for filtering fluids.*"—February 8; six months.

Amand Deplangue, of Lisle, in the Kingdom of France, but now residing in Leicester Square, Gentleman, for "*improvements in looms for weaving.*" Communicated by a foreigner residing abroad.—February 8; six months.

Edmund Rudge, Jun., of Tewkesbury, Tanner, for "*a new method or methods of obtaining power for locomotive and other purposes, and of applying the same.*"—February 8; six months.

James Hancock, of Gloucester Place, Walworth, for "*a method of forming a fabric or fabrics applicable to various uses by combining caoutchouc, or certain compounds thereof, with wood, whalebone, or other fibrous materials, vegetable or animal, manufactured or prepared for that purpose, or with metallic substances manufactured or prepared.*"—February 8; six months.

George Eugene Magnus, of Manchester, Merchant, for "*certain improvements in manufacturing, polishing, and finishing slate, and in the application of the same to domestic and other useful purposes.*"—February 8; six months.

Robert Willis, of the University of Cambridge, Clerk, Tonksonian Professor, for "*improvements in apparatus for weighing.*"—February 8; six months.

David Napier, of York Road, Lambeth, Engineer, for "*improvements in the manufacture of projectiles.*"—February 12; six months.

Antoine Blanc, of Paris, Merchant, and Theophile Gervais Bazille, of Rouen, Merchant, now residing at Sablonieres Hotel, Leicester Square, for "*certain improvements in the manufacturing or producing soda, and other articles obtained by or from the decomposition of common salt or chloride of sodium.*"—February 12; six months.

Thomas Robinson Williams, of Cheapside, Gentleman, for "*certain improvements in the manufacture of woollen and other fabric or fabrics of which wool or fur form a principal component part, and in the machinery employed for effecting that object.*"—February 14; six months.

Joseph Clarke, of Boston, Printer, for "*improvements in piano-fortes.*"—February 14; six months.

Gerard Ralston, of Tokenhouse Yard, Merchant, for "*improvements in rolling puddle balls or other masses of iron.*" Communicated by a foreigner residing abroad.—February 22; six months.

Richard Cuerton, Jun., of Percy Street, Middlesex, Brass Founder, for "*improvements in the manufacture of cornices, mouldings, and window sashes.*" Communicated by a foreigner residing abroad.—February 22; six months.

Thomas Kerr, of Forecrofts Dunse, in the county of Berwick, Esquire, for "*a new and improved mortar or cement for building, also for mouldings, castings, statuary, tiles, pottery, imitation of soft and hard rocks, and other useful purposes, and which mortar or cement is applicable as a manure for promoting vegetation and destroying noxious insects.*"—February 22; six months.

William Cook, of King Street, Regent Street, Coach Maker, for "*improvements in carriages.*"—February 22; six months.

John Hanson, of Huddersfield, Engineer, for "*certain improvements in meters for measuring volumes of gas, water, and other fluids when passed through them, and in the construction of cocks or valves applicable to such purposes.*"—February 22; six months.

William Winsor, of Rathbone Place, Middlesex, Artists' Colourman, for "*a certain method or certain methods of preserving and using colours.*"—February 22; six months.

Job Cutler, of Lady Poole Lane, Sparkbrook, Birmingham, Gentleman, and Thomas Gregory Hancock, of Highgate, in the same Borough, Mechanist, for "*an improved method of cutting corks and constructing the necks of bottles.*"—February 22; six months.

William Brindley, of Northwood Street, Birmingham, for "*improvements in apparatus employed in pressing cotton, wool, and goods of various descriptions.*"—February 25; six months.

Thomas Huckvale, of Over Norton, Oxford, Farmer, for "*improvements in ploughs.*"—February 25; six months.

Thomas Farmer, of Gunnersbury House, near Acton, Middlesex, Esquire, for "*improvements in treating pyrites to obtain sulphur, sulphurous acid and other products.*"—February 25; six months.

John Wilson, of Liverpool, Lecturer on Chemistry, for "*an improvement or improvements in the process or processes of manufacturing the carbonate of soda.*"—February 25; six months.

Richard Kingdon, of Gothic House, Stockwell, Surrey, Surgeon, for "*certain improvements in apparatus for the support of the human body, and the correction of curvatures and other distortions of the spine of the human body.*"—February 25; six months.

Thomas Milner, of Liverpool, Safety Box Manufacturer, for "*certain improvements in boxes, safes, or other depositories for the protection of papers or other materials from fire.*"—February 26; six months.

William Morrett Williams, of Bedford Place, Commercial Road, Middlesex, late of the Royal Military College, and Professor of Mathematics, for "*an improved lock and key.*"—February 27; six months.

TO CORRESPONDENTS.

In our last Number we inserted a drawing and description of the Traversing Screw Jack, but we omitted to state that it formed part of Mr. Curtis's *patent inventions.*

We shall be happy to receive from Mr. *Armstrong, our valuable contributor, the proffered illustrations alluded to at the conclusion of his communication in the present month's Journal.*

Mr. Thorold's new frame for Steam Engine, we were compelled to postpone, together with several other communications for want of space, we will endeavour to meet the wishes of our numerous contributors next month.

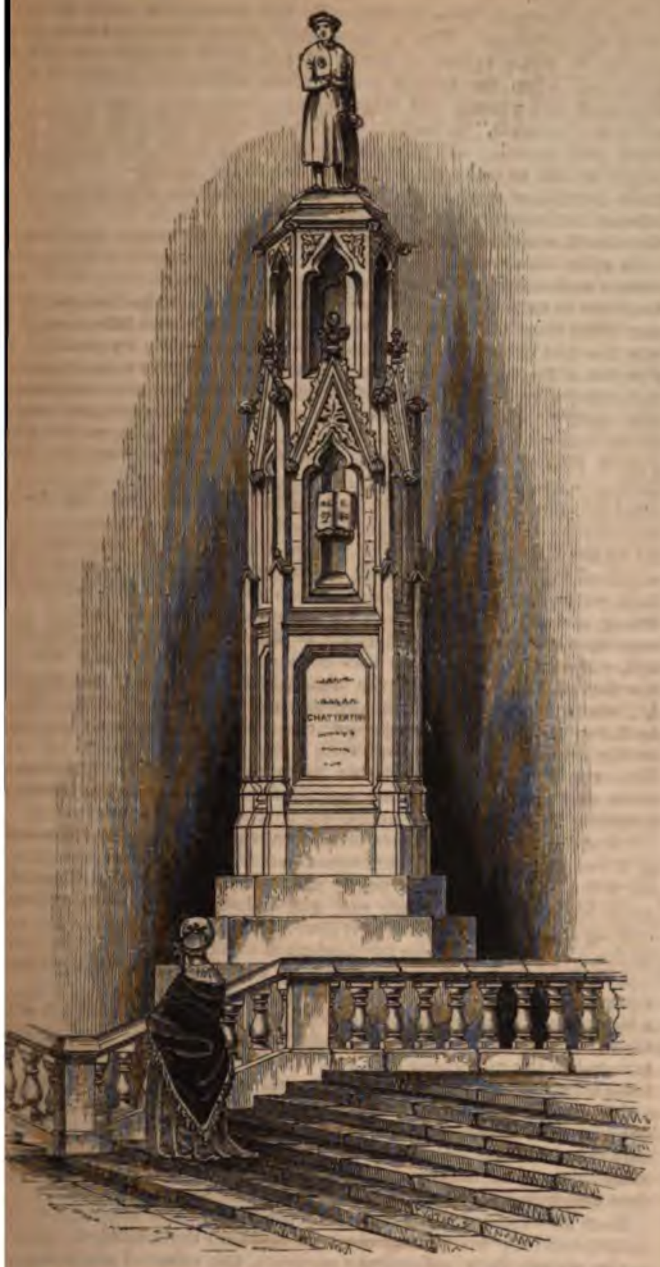
Communications are requested to be addressed to "The Editor of the Civil Engineer and Architect's Journal," *No.* 11, *Parliament Street, Westminster, or to Mr. Groombridge, Panyer Alley, Paternoster Row; if by post, to be directed to the former place; if by parcel, to be directed to the nearest of the two places where the coach arrives at in London, as we are frequently put to the expence of one or two shillings for the* porterage only, *of a very small parcel.*

Books for review must be sent early in the month, communications on or before the 20th (if with wood-cuts, earlier), and advertisements on or before the 25th instant.

The First Volume may be had, bound in cloth and lettered in gold, Price 17*s*.

⁂ The Second Volume may also be had, Price 20*s*.

MONUMENT TO CHATTERTON.

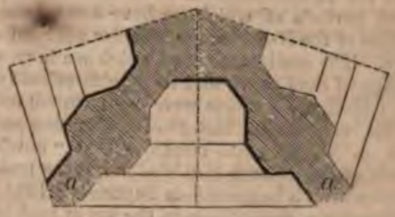


Admiration of Chatterton, and compassion for his untimely fate have o often evaporated in mere declamation, and it wanted the spirit of few individuals, and the talent of a disinterested artist to give the oet that tribute, to which every one acknowledged his title "The onderful boy who died in his pride," the bard who gave Bristol that tle in the literary world, which has since been maintained by Southey, d a right to expect from his fellow citizens a memorial which they d money to pay for and native talent to execute—The Bristolians ve shown good feeling in preserving in the museum of the Institute the Eve at the Fountain, and they would have shown still more, d they employed the pencil of Lawrence or the chisel of Baily upon subject so worthy of their talents, as the commemoration of a felw townsman.

To enter into a biography of Chatterton would be misplaced here, hile the leading incidents need but to be alluded to to recall the rembrance of his life, his childhood,* his relationship to Redcliffe his education in the neighbouring charity school, and his years of fretful toil as an attorney's clerk, are circumstances of local interest connected with the present monument. No site could be better chosen than one near the place of his birth and of his literary education, no garb could be more dignified than that which recalled the difficult position from which he had to emerge to distinction. It was within the walls of St. Mary's that he breathed the inspiration of his song it was there that he planned the tale of fiction which struck the literary world with wonder, it was there that he placed the stage on which the imaginary Rowley was to herald the fame of Chatterton. The discovery of the fiction is not to be regretted, it is only painful as it lĕd to the self destruction of one so promising and so talented, and the loss of a life which beamed with hope of better works. His fellow citizens have been loud in sounding his fame, but half their duty was undone while they left the tenant of the workhouse ground in Shoe Lane, without a stone to tell his name.

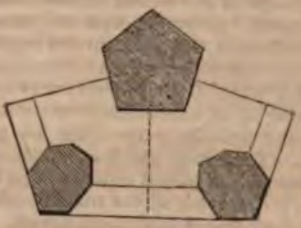
The people of Bristol have at last been alive to the claims upon them, but it is owing neither to their public spirit nor their generosity that the memorial is worthy of its subject. The paltry sum of one hundred pounds is what this rich city awards to commemorate its own glory, and that of its favorite son, and it is fortunate that the performance was not as mean as its reward. The monument, of Bath stone, is a Gothic cross, 31 feet high, bearing the statue of Chatterton, attired in the garb of the charity school in which he was brought up. The plan is pentagonal throughout, and harmonises with the rich architecture of the majestic church. The niches and tablet recesses are formed by alternate parallel surfaces with the face and side of the buttresses, as under:—

Plan of compartment in the middle stage of the Monument.
Scale ¼ an inch to a foot.



The upper stage which is not shown minutely in our engraving is composed of five angular shafts detached from the central pier whic supports the statue; the light and shade are therefore much more varied.

Plan of compartment in the upper stage of the Monument.
Scale ¼ an inch to a foot.



There are five inscriptions on the tablets in the lower stages, and the open book and the scroll in the hands of the statue are also inscribed, the two latter in Old English character. The work is well executed, the carvings in particular, which are designed after some of the fine models in Bristol Cathedral.

The monument was sure to excite interest from its locality, and this interest has been maintained by the skill with which the work is made to harmonize with the noble back-ground formed by the North Porch of the church, rich in all the luxuriant ornament of the fourteenth century. It is to Mr. S. C. Fripp, jun. an Architect of Bristol, that the public are indebted for this admirable work, and he has shown both judgment and true genius in preserving that harmony of tone, which was dictated by a due regard to the proper treatment of the subject. Had Mr. Fripp done otherwise he would have stepped beyond his proper sphere, and failed in producing a work which does him so much honor. He has by this monument added fresh interest to a time honored site, given his native city a new ornament, and a noble bard his long neglected tribute.

---

* Thomas Chatterton born 1758, died 1770.

ON DAGENHAM BREACH.

A brief account of the stopping of Dagenham Breach on the Thames digested from Captain PERRY'S *Narrative, published at London in* 1721.

ENGINEERING has only within the last fifty or sixty years been considered a liberal profession in Great Britain. Formerly from its limited extent, and the want of education and science on the part of its professors, it was looked upon as a subordinate although an useful occupation. Although the profession has so greatly extended itself within that limited period as now to be recognized as a scientific avocation, we must not on that account suppose, that formerly there were not men engaged in its arduous works, who by their originality and boldness may be considered as worthy of memory. The work of which we are to subjoin a brief account was (like some others at the same period) conducted by a man of real genius and industry—one who although obliged by the slight encouragement given to his profession, to execute by personal *contract* the works which he designed, yet cannot be regarded as a mere pecuniary adventurer. Of his history all the information I have been able to gain has been gleaned from his writings, from which it would seem, and it is worthy of remark that his own country afforded such small scope for his genius, that he was obliged at one time to seek a livelihood under the Czar of Muscovy.

With regard to the work by which he so much distinguished himself, it was one of those unpretending yet costly works, the call for which, had it not been irresistible would have probably been disregarded, but it was a work that could admit of no delay, as every lost opportunity added to the difficulty of its completion. And it is to this cause we must attribute the laying out of such a large sum of public money in times so deficient of the spirit of enterprise.

Breaches in the Thames seem to have been of frequent occurrence in the earliest periods of which we have accurate accounts. So far back as the time of the Romans, the Thames afforded employment for the ingenious. The earliest work of which we have any information, was the drainage of Southwark and its neighbourhood; this was a sort of work with which the Romans were well acquainted. Sir William Dugdale in his voluminous history of Embanking and Draining (fol., London 1772, p. 81, 2d edit.) mentions that "howbeit these banks being not made strong enough to withstand those tempestuous storms and violent tides which happened in September 1621, Cornelius Vermuden, gentleman, (an expert man in the art of banking and draining) being treated withal by the commissioners of sewers appointed for the view and repair of the breaches then made, undertook the work and perfected it; but such being the perverseness of those *as* were owners of the lands assessed by the commissioners to pay their proportions thereof—upon complaint therefore made to the said commissioners, he the said Cornelius in recompence of his charges had parcel of the said lands assigned unto him, which assignation was by the king's letters patent confirmed to him the said Cornelius and his heirs."

I can find no account of the extent of this breach or the manner in which it was stopped. Although from the handsome remuneration with which the services of this eminent fen engineer were rewarded, we must suppose his task to have been a formidable one.

The breach with which Captain Perry was connected, was occasioned by the blowing up of a small sluice or trunk, that had been made for carrying away the drainage water of the low grounds adjoining the banks of the river. The ditch which communicated with this sluice was at first not above 14 or 16 feet broad, so that had the accident met with the attention it deserved, all the trouble and expence consequent on stopping the breach would have been saved. Instead however of prompt measures being taken, the damaged sluice was in the first instance neglected, and it was not until the tidal water had greatly enlarged the gap that attempts were made to stop the breach; but by this time the water had scoured away the clay bottom, and began to act upon what our author calls "Moorlogg," and the gravel and sand beds which lie out a little way below the surface of the ground. Moorlogg is described as a vein of matted brushwood, with nuts and pieces of rotten wood interspersed. In these soft strata the scour proceeded with great rapidity, and baffled all attempts which were made to check its progress during a period of no less than 14 years. In that time the tiny ditch had ramified above a mile and a half into the land, and its main branch had attained a breadth of about 400 or 500 feet, and a depth of from 20 to 30 or 40 feet. By a computation made at the time, no less than about 120 acres of marsh land had been carried into the Thames by this tidal river. The ground thus excavated and carried into the river was composed of clayey ground moorlogg, about a foot or 16 inches of blue clay, and at the bottom gravel and sand.

Nor was the loss of sand by any means the most serious consequence connected with this inroad of the tide; a more important although perhaps less apparent evil was the injurious effects produced by so large a quantity of matter lodging both in the higher and lower reaches of the Thames.

The landowners were neither idle nor illiberal in their efforts to check the incursion. The method they adopted was contracting the channel to some extent by means of pile-work advanced from both sides, and when the stream was confined within a moderate channel they sunk old vessels and large boxes; these were backed on both sides by "*maands*," or baskets filled with chalk, and bags filled with earth and gravel. All this was done during neap tides, that they might be able to make good the dam before the springs. Engaged in these operations were those in the vicinity, and all who had a direct interest in their success, and many lost their lives by the violence of the current which swept them away, and carried them into the Thames.

In spite however of all their activity and perseverance, the tide always succeeded in boring through below the obstructions which had been put in its way. With such violence did it act that on one occasion when they had sunk the "Linn" man-of-war and two other vessels, the first ebb of the tide swept them so completely away that there was not a fragment to be seen, and as Captain Perry asserts, "three days after there was upwards of 50 foot depth at *low* water where she was sunk." This depth, however, seems very extraordinary, and is surely overstated. He mentions another case which certainly gives a good idea of the force of the current (pp. 17, 18). "Another gentleman concerned (since my late stopping the breach) speaking of what had passed with them in their attempts, merrily told me that at one of those times when they had made a shut (or attempted to do it) by the sinking among other things, a large chest or machine upwards of 80 feet long, the next day afterwards the violence of the back water setting out of the levels upon the tide of ebb, worked so strong underneath the bottom of this machine that she bolted up at once above water, and discharging as she rose most part of the chalk and stones with which she had been sunk, drove directly with the current out of the mouth of the breach, whereat a gentleman standing by, who was a considerable landowner, and had been at great expense in the work, being much surprised, ran along upon the wall (or bank) on the side of the breach, and with great earnestness called out, stop him, stop him, oh stop him! this machine driving directly down the river, and sometimes sticking against the bottom and sometimes rebounding above the water again, when it came down in view of the ships at Gravesend, they were alarmed at the unusualness of the sight, as it emerged out of the water sometimes with and sometimes athwart the tide, and as they ride pretty numerous there at that time, they were forced to sheer, some one way and some another to avoid receiving any mischief from it. It drove from thence as far as the buoy off the Nore, and there run aground upon a shoal."

At a later period they succeeded in keeping in their places some vessels which had been sunk by driving piles on each side, but although a large quantity of chalk in bags and baskets had been sunk all round them, the tide still rose and fell within. So much were the public interested in the operations that a power was given to impress all chalk vessels that passed on the river, so that sometimes 10 or 15 freights a-day were delivered at the breach, which was actually reported to have in some measure retarded the London buildings. An extraordinary tide happening soon after, put a stop at once to the embargo on chalk, and to the works at Dagenham, by removing the whole structure which had been erected at such cost and labour.

Here all exertions on the part of the landowners naturally enough ended, and they would no doubt have made up their minds to abandon to the waters their unfortunate property, the value of which was not adequate to warrant a farther expenditure, had not the destructive effects of the silt lodging in the Thames arrested the attention of the House of Commons, which passed a bill in April 1714, for effectually stopping the breach at public expense, and this they farther extended to removing the silt which had been deposited in the river, and making good the adjoining banks. Captain Perry offered to execute the works for £24,000, and a Mr. Boswell for £16,500, which being the lowest offer was accepted.

Mr. Boswell was first to make piers and then sink 6 ponts or chests 60 feet in length, 30 feet broad, and made salient at each end like the starlings of a bridge. These were to be placed in the bottom 12 feet apart, and the spaces were to be made up with piles and other timber work.

In the chests were to be sluices which when shut down were wholly to exclude the water. But the gap was no sooner contracted by the piers than the current scooped out the soft bottom which was the cause of the miscarriage of all the former plans. Thus was Mr. Boswell's first plan completely set aside. He had then recourse to one enormous box, but whenever he attempted to contract the water-way, as certainly did the bottom wear and assume an irregular deep rutted surface, so that after all these schemes he was constrained to return to the old system of staunching the current by the sinking of ships, ponts, and bags of chalk. The only new feature which he introduced into the plan was the fixture of enormous hair bags filled with chalk (some of them 30 feet in length) to the vessels bottom, which bags it was expected would have adapted themselves to the form of the bottom, and thus preserved a closer connection than had been effected before. He accordingly carried out his scheme, having sunk two vessels and the large pontoon which he had previously made, and he also surrounded the whole fabric with enormous quantities of chalk. In addition to this he had placed in the banks a little below the breach, two sluices which were intended to have relieved the pressure, but which according to Captain Perry could not from their construction and level have been of any service. The very first tide after the vessels had been sunk, operated with such energy on the bottom, that the whole fabric was totally destroyed by the second day after. The vessels laden with chalk and rubbish were thrown up, and the enormous pontoon gave the finishing blow by starting up and tearing to pieces the pile work and planking.

Here ended Mr. Boswell's services, and the trustees appointed by the bill having nominated a committee, inspected the ground and drew up a report dated November 7, 1715. The following soundings taken by the committee and given in their report are as follows: "on the west side 20 feet below the works to the south, 40 feet deep. On the south side 20 feet from the stern of the Abindon (one of the ships sunk in the said breach, 30 feet. On the same side, 15 feet from the stern of the Recovery, (another ship) 18 feet. Ten feet south from the piles on the east side of the breach 18 feet. Between the ships and the piles on the west side 29 feet. Betwixt the works to the northward near the piles on east side 24 feet. At the end of piles on east side 19 feet. Fifty feet north from said piles 31 feet. Fifty feet farther north 50 feet. Twenty-five feet north of the piles on the west side 26 feet. Fifteen feet north from piles in west side 14 feet. Close to said piles on west side 20 feet. Coming about the piles to the southward we find these depths following, viz., 29, 24 and 18 feet."

What sort of settlement was made with Mr. Boswell does not appear from the narrative, but new offers were obtained. Captain Perry gave in an account of his scheme, which was this. To have a sluice made in the embankment with a trench connected with the backwaters. To drive a row of *dovetailed* piles across the gap, leaving their heads not more than 18 inches or 2 feet above low-water mark; so that in driving these piles little or no difficulty would be experienced from the current. Forty feet from the row of piles on either side a sort of low coffer-dam 18 or 20 feet broad, to be formed of piles and boarding, and to be filled with chalk to prevent the toe of the embankment from spreading. On the outside of these coffer-dams a wall of chalk to be made as a farther security. The dam itself to be composed entirely of earth, and in the course of the erection care to be taken always to shut the sluice when the backwater falls to the level of the top of the work. In this way there will at no time be a higher face for the water to flow over.

This was evidently a judiciously contrived scheme, and shows that the projector of it had a just conception of the nature of the difficulties he was to contend with, which were a soft, unstable bottom and a powerful current of water. He was well aware that a dam of the thickness he contemplated would easily sustain the *pressure* of backwater, although from its being composed of soft materials, he could not expect it to withstand the action of water rushing over it. Experience had proved that such materials as chalk could not from the large interstices necessarily existing between the pieces, form anything like a water-tight dam, and if they had, the softness of the bottom was enough to render such a plan impracticable. The first grand points were to secure the treacherous bottom, and make a heavy and water-tight dam. These difficulties were well provided for by the use of dove-tailed piles and a clayey soil. The second point was to prevent the ebb and flood tides from rushing over the top of the dam when it was in progress; this difficulty was removed by keeping the backwater constantly on a level with the top of the work.

After much communing and trouble on both sides, a contract was entered into with Captain Perry, who was to perform the works for £25,000, he being bound to advance £5000, and to expend that sum on the works, after which he was to be supplied by the trustees. If the work were unsuccessful, the £5000 was of course lost to Captain Perry, or, rather, to the friends who had advanced it. Should, on the other hand, the work be successful, but be rendered very costly from any unforeseen accident, he was to be recommended to the consideration of Parliament.

After all this had been settled, Captain P. seems to have been much annoyed by Mr. Boswell and a host of *mathematicians*, who declared his plan impracticable. He, however, came through their hands, according to his own account, *non sine gloria*, as well as through the ordeal of sundry examinations and meetings.

No time was lost in commencing the work; but the sluice, from the softness of the ground, was not carried to its contemplated depth, which incurred the necessity of another being made. From some cause or other matters seem to have been mismanaged, for it was not until the spring of 1717 that the second sluice was completed, and the breach was not stopped till June. For this tardiness he pleads several excuses, but he does not succeed in satisfying the reader as to his promptness. The time for completing the dam had now nearly approached, and his friends who had advanced the money, became impatient, and so importuned him to push on the work, that he allows he was persuaded to admit stuff of an inferior binding quality in the formation of the dam. A great deal of bad earth was also put in without his knowledge, when the men were working at night, and his assistants, five in number, seemed rather to conspire against him than to back him in any of his difficulties, so that what between grumbling friends, rebellious assistants, and an impatient public, he was constrained to collect together all the force he could muster in the neighbouring country, in spite of the high wages of 36*s*. per week. These labourers, assisted by men from the royal yards of Woolwich and Deptford, soon made a satisfactory difference in the appearance of the work, but a most unsatisfactory difference in its quality. Hitherto each tide's work had been made in offsets or scarcements, about 7 feet broad and 3 feet high, these supported by piles and planking on the side, and protected by reeds on the top, had been able to resist the action of the tide when it came in. One of the assistants, however, proposed during the neaps to set all hands to work and make a narrow wall of earth, unprotected by reeds or planking, and build it so rapidly as to get it above the level of the springs before they should come on, and thus at once to exclude the tide from the marsh. Captain Perry unfortunately gave in to this proposal, trusting to the tide's being of its ordinary height. There happened, however, an extraordinary tide, occasioned by a storm at N.W., which tide rose about 6 inches higher than the top of the little wall, and pouring over it, soon washed it down, and the water thus widening its inlet, rushed over in such volumes, that in the course of two hours the dovetailed piles were laid bare.

When Captain P. observed the tide rising with unprecedented rapidity (which it did), he heightened the little wall with piles and boarding set on edge on the top, but the water insinuating itself between the boards and the earth, led to the calamity we have mentioned, and which the Captain says was due merely to the fortuitous occurrence of an extraordinary tide. Men were employed in digging down the earth, and otherwise easing the passage of the water over the dam, as well at the first inbreak as at subsequent tides, by which means the violence of the current was speedily checked.

This accident, as might have been supposed, caused many reports about the general insufficiency of the work, and the erroneous principles on which it had been carried on. This did not, however, deter Captain P. from proceeding with the repair during the winter months, and in raising the dam this second time, he was a great deal more scrupulous about the quality of earth used in its formation, and in the end of June, 1718, "the tide was again turned out of the levels in the time of neap as before, only that the work, after the tides were turned, was now continued to be raised by set-offs with piles and boards, and well covered over at the top, so that though a thin body of water did several times pass over into the levels, it was easily let off by the sluices. The trustees now visited the work, and expressed themselves satisfied with the manner in which this part of the work had been accomplished. After their visit he dammed up the two canals communicating with the sluices, and any subsidence of the dam he at once made up with new stuff The work being now in an apparently safe condition, the Captain left for Dover, where he was to report on the Harbour, and on his return he was seized with ague, and when he was recovering, but was still confined, on the morning of the 30th of September, 1718, a message was sent to him conveying the mortifying intelligence that the tide had again demolished the work. In spite of his ague he at once visited the spot, and found the sluice dams standing and the sluices shut, and, in short, nothing done towards easing the passage of the waters. He immediately summoned as many hands to his assistance as the neighbouring country could, on such short notice, produce; but the water had made such havoc, that in six tides about a hundred feet of the dovetail piles, &c., were torn up and carried away, and in one place there was about 20 feet greater depth than there was before the work was begun.

How this accident occurred was for some time a mystery, but it subsequently came out that the watchman had, instead of attending at his post, been reviving his frozen carcase at a neighbouring beer shop.

By this time the Captain's funds had been greatly reduced, and he applied to the trustees for a remittance, which they, however refused and he was reduced to the necessity of canvassing his friends for further sums which was after some difficulty supplied. This was in February, and it was not till the winter had expired that the gap was squared and filled up and the tides were expelled for the third time on the 18th of June. He continued also to increase the height of the dam till it was two feet above the level of a high tide that occurred in November, occasioned by the conjoined effects of a great storm and the moon's being in perigee.

It appears from his statements that the works had left him in a sadly crippled state as far as regarded his purse, and he concludes by urging the trustees at least to make up his deficiency that he might be enabled to steer clear of his creditors. He says "If I may—now the work is completed and so many years (5) spent therein, be but freed from the debts and engagements into which it has plunged me, and set at liberty to offer myself upon some other work, whereby I may be of use to my country and have an opportunity of getting my bread; I shall cheerfully submit to whatsoever shall be thought fit as to any consideration or reward to myself." He further volunteers his services for the improvement of the ports of Dublin and Dover, reports on both of which he subjoins to his narrative. I cannot, from the want of access to proper data (occasioned by a casual visit to the country), take any step towards ascertaining in what way the petition of our author was received by the Trustees and the house of parliament, as such information is not contained in his own narrative, that he was in some way freed from actual imprisonment and allowed to go at large in the practice of his profession, seems evident from the book which he subsequently published. In the Bibliotheca Britannica there is mentioned in the short catalogue of his labours as an author "Proposals for the draining the Fens in Lincolnshire. 1727 fol. His death is said in the same book to have taken place in 1733.

I shall now conclude by explaining my reasons for thus having brought a condensed view of this half forgotten work before the public through the medium of these widely circulated pages. Many who might have taken an interest in the work have no opportunity of reading Perry's own narrative from its unfrequent occurrence; and from the somewhat incoherent and cloudy stile in which it is written, the reader is frequently a little puzzled to know exactly what the author would be at. Even the description of his scheme (simple though it was) is not by most readers to be apprehended by a single perusal. These reasons and the wish to make the name of the successful projector of so formidable a work, better known to the profession must excuse me for occupying so much valuable room.

STEAM VESSEL INQUIRY AND INQUISITION.

The labours of the Commissioners have at last brought to light the promised Shiloh, in the shape of such a bill, as was never before seen. and we sincerely hope will never be seen again. The abstract which we have perused is such as was to have been expected from its concoctors, and the sources from which they derived their ideas of legislation; the bill seems to be a cross breed between a French police ordonnance, and an excise or custom-house act of parliament. Such inspectors and such surveyors, and such modes of action, were never before contemplated in this country, at variance with the recognized laws of all sound economy, they are obviously at variance with the national character, and the interests of the empire. It is by unshackled industry and by that alone that this mighty empire has been created, and that it is to be maintained, and it is on the prosperity of steam navigation in particular that our strength depends, and the means of profiting by our resources. What therefore can exceed the insanity which proposes to place inventors and manufacturers under a yoke, which in every other country has fettered the progress of science, and retarded the advancement of the nation? What are we to expect when we see spies under the name of surveyors introduced not only into the workshops, but into the study, not to be contented by tampering with the machinery, but who must meddle with the very design itself. Men who are to constitute a new middle class between the manufacturer and the shipowner, who are to tell one what he is to make, and the other what he is to buy, who are to be censors of the noblest efforts of invention, and judges of last resort in cases where the most learned disagree. Do we believe that the plague introduced among marine engineers will fester among them alone without extending to every other class of engineers? We neither believe it, nor can others. It is what is done in France and what will be done here; the police will not stop till they regulate the working of the engine in the factory, as well as the progress of the steam boat on the water, and the locomotive on the rail. To denounce this to Englishmen is unnecessary, to name it is to point out its train of informers and penalties, and to insure its instant condemnation.

The motives which inspire this bill, can have no origin in common sense. they can proceed only from some hateful inspiration, and what that is it would be difficult to point out. The least excusable would be to enable a government, always in arrear of private enterprise, to pillage in other establishments for the maintenance of the new factory at Woolwich. We cannot believe that they would hesitate to do so, when they are regardless in every other point.

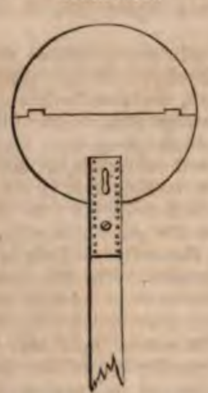
We felt it our duty to oppose this measure from its first suggestion. we have followed it with uncompromising hostility throughout its threatening progress, and we were not inclined to relax when we saw it assume a shape so formidable. Having issued a circular to the manufacturers, meetings have been held at which men, the first in talent, enterprise and wealth in the country have come forward to prove by their own conduct the justice of the course which we had pursued in their defence, and we trust that such an opposition is organized as will at least paralyze the operations of this obnoxious bill, if it do not destroy it in its birth.

We have on former occasions shown that the evidence on which the report was founded was most trumpery and insufficient, and we trust that our readers are convinced, that the only effective operation of the proposed measure would be to injure the best interests of the country. Commissioners of course are to be appointed, but where men competent for the duty are to be found, none but the concoctors of the bill can devine, for no practical man can. Qualified surveyors are still less to be expected, and raw theorists or ignorant empirics seem to be the classes from which these inquisitorial functionaries are to be supplied. To them are to be confided the most extraordinary powers, not only the mere privileges of meddling, but judicial authority over their victims. Even district surveyors are to have all the extra legal powers of a parliamentary committee, to call for papers and for documents, and to examine persons on oath, to prosecute for penalties, and to receive half those penalties for their own share. This is the plan to which all principles of justice, of truth, and of experience are to be sacrificed, and by which the talents and intellects of our ablest men are to be subjected, and manufacturers, some of whom have not less than a hundred thousand pounds invested in their business, are to be hampered and destroyed.

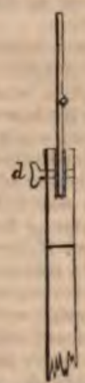
SURVEYING POLES.

Sir,—Allow me through the medium of your interesting Journal, to suggest to practical Surveyors a very useful, although seemingly trivial addition to the ordinary Surveying Poles, as a substitute for the piece of paper commonly used to render the pole distinguishable from a long distance when driving a line over land.

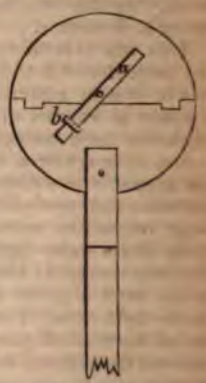
Front view.



Side view.



Back view.



It consists of a disc of tin about six inches in diameter, which for convenience in carrying may be joined across the middle as shown in the accompanying sketch; its open position being secured by a little bar A to be turned into the latch B. An iron ring or socket C is screwed on the top of the pole and receives the disc in a slit while the screw D secures it. It is almost needless to remark that the disc should be painted white on both sides.

Yours obediently,

G. P. DEMPSEY.

11, Craven-street. Charing Cross,
March 19, 1840.

OF THE OBLIQUE OR SKEWED ARCH.

WHILE the system of communication from one part of the country to another continued to be transmitted through the medium of turnpike roads alone, the instances were few and far between in which the erection of an *oblique or skewed arch* became necessary. Indeed, unless in very confined and precipitous situations, we do not recollect a single case, where a structure of this kind has been resorted to for the purpose of carrying a road over a river or streamlet; nor was it requisite that it should, for in laying down the original plan of a road, the surveyor would generally possess the power of directing it, so as to intersect a river at right angles to its banks, and thus the necessity of carrying a bridge obliquely across the stream would be altogether avoided.

On the introduction of canals however, the circumstances were very materially altered, for it seldom happened that the direction of a road already constructed, was permitted to be changed for the purpose of accommodating it to the line of a projected canal, so as to traverse it perpendicularly; and in many cases it would be found inconvenient if not totally impracticable, to guide the canal across a road at right angles to its direction; hence the necessity of having recourse to the *skewed arch*, and accordingly, on the various canals that intersect the country, erections of this sort are very numerous, and the methods by which some of them have been constructed are exceedingly ingenious.

But it is in the construction of railroads that the *skewed arch* meets with its most important application, for in almost every instance where one line is intersected by another, the intersection takes place with a lesser or greater degree of obliquity, and several viaducts of considerable length are wholly supported by a connected range of oblique arcuation. This being the case, it is an object of the greatest importance that the correct principles of construction should be rightly understood, and it is for the purpose of establishing those principles and rendering their application easy, that the present investigation has been instituted.

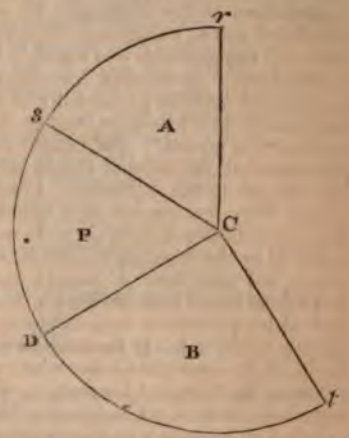
There are few architectural subjects that have excited a higher degree of interest than the present, and there is none that has given rise to a greater number of curious, abstruse and elegant theories, or been the cause of more violent and protracted controversies. One party contending that the just principle of construction, is to place the several courses of which the arch is composed in a direction parallel to the abutments, the direction of the coursing joints being regulated by the nature of the curve on which the arch is built. A second party maintains, that the several courses should be placed perpendicular to the face of the arch as far as the obliquity on both sides of it, and that the middle portion which stands upon the square, should have the courses laid parallel to the imposts or abutments. A third class of disputants insists upon laying the several courses perpendicular to the face of the arch throughout its whole extent, and trending them to the abutments in an angle dependent on the given obliquity; while a fourth class proposes to direct the courses in such a manner as to traverse the arch spirally like the threads of screw.

The subject itself is worthy of a mechanical investigation, and since we have been induced to direct our attention to it, we shall endeavour to the utmost of our power to set the question at rest, and point out the true principles of construction upon which depends the maximum of stability and strength.

In taking a minute and comprehensive view of the subject to which our present enquiries are directed, it will be proper for the sake of system, to consider the various theories above specified in the same order as we have described them. This in the first place will lead us to the contemplation of that variety where the courses are laid in a direction parallel to the imposts, and in which, (supposing the arch to be a semicircle,) the planes of the coursing joints on being produced to intersect the plan or base of the arch, are everywhere constrained to terminate in the axis or straight line, which passing through the centre of the semicircle divides the plan into two equal and similar portions.

The principle upon which the mechanical delineation of this particular form is founded, is exceedingly curious and interesting, referring as it does to the developement of the several parts of a right angled triangular pyramid upon a plane surface. This circumstance introduces a species of calculation that is not generally understood by practical architects, since it claims as its basis the doctrine of Spherical Trigonometry, a subject to which the attention of practical men is very seldom directed, although its applications are both numerous and important, and its principles remarkable for their elegance and simplicity. The objects of calculation are, the angles at the vertex of the pyramid comprehended between its edges, and the angles which measure the mutual inclinations of its bounding planes. Now, in order to assimilate the necessary operations to the determination of the levels or moulds by which the several voussoirs or arch stones are framed, we have only to consider the nature of the figure arising from the mutual intersections of the planes to which the moulds are severally applied.

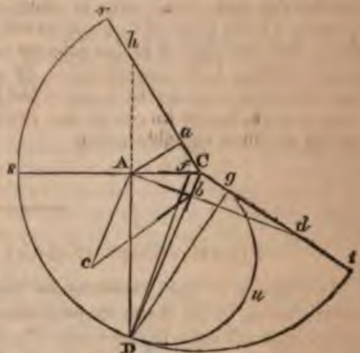
If the face or elevation of the arch, and the planes of the coursing joints or beds of the several voussoirs, be produced to intersect each other in the plan or base on which the arch is raised, they will, in connexion with the said plan, manifestly constitute a series of triangular pyramids having their vertices in the centre of the semicircle, and if the face of the arch be perpendicular to the plan, the pyramids will be all right angled; that is, two of the bounding planes in each, namely, the face and plan of the arch will intersect one another in an angle of ninety degrees.



Let the planes of the beds or coursing joints be produced externally, and conceive a circular arc to be described in each of the bounding planes, and having the vertex of the pyramid as a centre; then, the figures thus constituted will respectively resemble that which is exhibited in the margin, and upon the developement of which the construction of the arch depends.

A, part of the arch. P, part of the plan. B, part of bed prolonged.

If the middle plane or plan sCD be supposed to be fixed, while the extreme planes rCs and DCt are elevated about the lines Cs, CD, till the points r and t, as also the radii Cr and Ct coincide, the nature of the figure thus formed will become manifest, and the expansions of its several parts upon a plane surface, may be effected in the following manner.



With the chord of 60 degrees taken from a scale of any convenient magnitude at pleasure, and about C as a centre, describe the circular arc $rsDt$, upon which and from the same scale of chords, set off rs and sD, respectively equal to the measures of the angles at the vertices of the perpendicular planes rCs and sCD.

Draw the radii Cr, Cs and CD, and in the radius Cr take any point a at pleasure, and erect the perpendicular aA meeting the radius Cs in the point A. At the point A determined in this manner, erect the perpendicular AD meeting the radius CD in the point D. From A, and on the radius Cs set off Af equal to Aa and draw Df. Upon CD as a diameter, describe the semicircular CuD, in which lay off the chord Cg equal to Ca, and Dg equal to Df and draw the radius Ct.

The above operation developes the triangular pyramid as far as it relates to the construction of the arch in question; DCt being the bevel of the bed or coursing joint, and AfD the bevel between the coursing joint and face of the arch. But in order to exhibit the complete developement of the figure, it is necessary to determine the angle which measures the inclination of the planes sCD and DCt; that is, the angle contained between the plan of the arch and the bed of the voussoirs for any particular course. From A or any other point whatever in the radius Cs, let fall the perpendicular Ab, carrying it forward to meet Ct in d; then is Ab the base, and bd the hypothenuse of a right angled plane triangle, between which the required angle lies. At the point A in the straight line dA, erect the perpendicular Ac, and make bc equal to bd; then is Abc the angle sought, which having been found, the developement of the pyramid is complete.

The nature and principles of the above construction will be readily perceived by reversing the process; that is, by recomposing the figure from its constituent planes and the angles which measure their inclinations: and for this purpose, let the two extreme planes rCs and DCt be turned about the radii Cs and CD, while the middle plane sCD remains fixed; and at the same, let the triangular planes AfD

and $A\,b\,c$ be respectively turned about the lines $A\,D$ and $A\,b$. Then it is manifest, that when the points r and t are made to coincide, the radii $C\,r$ and $C\,t$ coincide also, and form one of the edges of the triangular pyramid, as may be seen by elevating the corresponding planes in the preceding diagram; and by this means the figure is recomposed in so far as respects its constituent planes. Another step of the composition is effected by bringing into coincidence the straight lines $A\,a$, $A\,f$, and $D\,f$, $D\,g$; and when $b\,c$ falls upon $b\,d$ the structure is complete, both as respects the bounding planes and the angles which measure their inclinations.

It now remains to calculate the several parts of the pyramid, on the supposition that the angles at the vertices of the planes $r\,C\,s$ and $s\,C\,D$ are given; and in order to this,

Let $c = r\,C\,s$, the angle at the vertex of the plane $r\,C\,s$, which corresponds with a portion of the face of the arch,

$b = s\,C\,D$, the angle at the vertex of the plane $s\,C\,D$, which corresponds with a portion of the plan or base, and is perpendicular to $r\,C\,s$,

$a = D\,C\,t$, the angle at the vertex of the plane $D\,C\,t$, which is a portion of the bed or coursing joint, and subtends the inclination of the planes $r\,C\,s$ and $s\,C\,D$,

$B = A\,f\,D$, the angle that measures the inclination of the planes $r\,C\,s$ and $D\,C\,t$,

and $C = A\,b\,c$, the angle that measures the inclination of the planes $D\,C\,t$ and $s\,C\,D$.

This notation being agreed on, let $C\,A$ be made the radius; then by the definitions of trigonometry, $A\,a$ and $C\,a$ are respectively the sine and cosine of the angle $A\,C\,a$, while $A\,D$ is the tangent of the angle $A\,C\,D$. But by the construction, $A\,f$ is equal to $A\,a$, and consequently $A\,f$ is equal to the sine of the angle $r\,C\,s$; therefore, by the principles of plane trigonometry, we have

$A\,f : A\,D :: \text{rad.} : \text{tan.}\ A\,f\,D$; that is, $\text{sin.}\ c : \text{tan.}\ b :: \text{rad.} : \text{tan.}\ B = \text{tan}\ b, \text{cosec}\ c$.

Here we have determined the angle of inclination between the planes $r\,C\,s$ and $D\,C\,t$, and a similar process will discover the angle $A\,b\,c$, or the inclination between the planes $s\,C\,D$ and $D\,C\,t$. Thus, since $C\,A$ is radius, $A\,b$ is the sine of the angle $s\,C\,D$ to that radius, and by construction, $A\,c$ is equal to the tangent of the angle $A\,C\,a$, for $A\,c$ is equal to $A\,h$, and $A\,h$ is evidently the tangent of the angle $A\,C\,a$ to radius $C\,A$; therefore, by plane trigonometry, we get

$A\,b : A\,c :: \text{rad.} : \text{tan.}\ A\,b\,c$; that is, $\text{sin.}\ b : \text{tan.}\ c :: \text{rad.} : \text{tan.}\ C = \text{tan.}\ c, \text{cosec.}\ b$.

We have next to determine the angle $b\,C\,d$ in the plane $D\,C\,t$, and for this purpose it is only necessary to recollect, that $C\,g$ is equal to the cosine of $A\,C\,a$, and $C\,D$ equal to the secant of $A\,C\,D$; hence we have

$C\,D : C\,g :: \text{rad.} : \text{cos.}\ D\,C\,g$; that is, $\text{sec.}\ b : \text{cos.}\ c :: \text{rad.} : \text{cos.}\ a = \text{cos.}\ b, \text{cos.}\ c$.

And exactly in the same manner, if any other two of the parts be given the rest may be found, and the several results when calculated and reduced to their simplest form, are respectively as exhibited in the following table:

Table of formulæ for calculating the several parts of a right angled triangular pyramid standing on a spherical base.

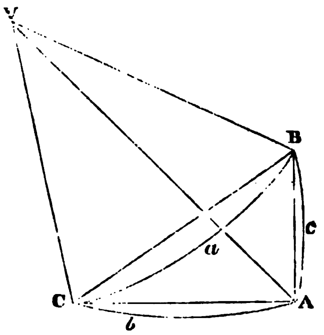
	Values of the angle B, *subtended by the base or plane* A V C.
1	$\text{sin.}\ B = \text{sin.}\ b\ \text{cosec.}\ a$.
2	$\text{sin.}\ B = \text{sec.}\ c\ \text{cos.}\ C$.
3	$\text{tan.}\ B = \text{sec.}\ a\ \text{cot.}\ C$.
4	$\text{tan.}\ B = \text{tan.}\ b\ \text{cosec.}\ c$.
5	$\text{cos.}\ B = \text{cot.}\ a\ \text{tan.}\ c$.
6	$\text{cos.}\ B = \text{cos.}\ b\ \text{sin.}\ C$.

	Values of the angle a, at the vertex of the hypothenusal plane B V C.
1	$\text{sin.}\ a = \text{sin.}\ b\ \text{cosec.}\ B$.
2	$\text{sin.}\ a = \text{sin.}\ c\ \text{cosec.}\ C$.
3	$\text{tan.}\ a = \text{tan.}\ b\ \text{sec.}\ C$.
4	$\text{tan.}\ a = \text{tan.}\ c\ \text{sec.}\ B$.
5	$\text{cos.}\ a = \text{cos.}\ b\ \text{cos.}\ c$.
6	$\text{cos.}\ a = \text{cot.}\ B\ \text{cot.}\ C$.

	Values of the angle c, at the vertex of the perpendicular plane A V B.
1	$\text{sin.}\ c = \text{sin.}\ a\ \text{sin.}\ C$.
2	$\text{sin.}\ c = \text{tan.}\ b\ \text{cot.}\ B$.
3	$\text{tan.}\ c = \text{tan.}\ a\ \text{cos.}\ B$.
4	$\text{tan.}\ c = \text{sin.}\ b\ \text{tan.}\ C$.
5	$\text{cos.}\ c = \text{cos.}\ a\ \text{sec.}\ b$.
6	$\text{cos.}\ c = \text{cos.}\ C\ \text{cosec.}\ B$.

	Values of the angle C, *subtended by the perpendicular plane* A V B.
1	$\text{sin.}\ C = \text{sin.}\ c\ \text{cosec.}\ a$.
2	$\text{sin.}\ C = \text{sec.}\ b\ \text{cos.}\ B$.
3	$\text{tan.}\ C = \text{sec.}\ a\ \text{cot.}\ B$.
4	$\text{tan.}\ C = \text{tan.}\ c\ \text{cosec.}\ b$.
5	$\text{cos.}\ C = \text{cot.}\ a\ \text{tan.}\ b$.
6	$\text{cos.}\ C = \text{cos.}\ c\ \text{sin.}\ B$.

	Values of the angle b, at the vertex of the plane or base A V C.
1	$\text{sin.}\ b = \text{sin.}\ a\ \text{sin.}\ B$.
2	$\text{sin.}\ b = \text{tan.}\ c\ \text{cot.}\ C$.
3	$\text{tan.}\ b = \text{tan.}\ a\ \text{cos.}\ C$.
4	$\text{tan.}\ b = \text{sin.}\ c\ \text{tan.}\ B$.
5	$\text{cos.}\ b = \text{cos.}\ a\ \text{sec.}\ c$.
6	$\text{cos.}\ b = \text{cos.}\ B\ \text{cosec.}\ C$.



The above table contains the simplest forms of the equations necessary for resolving the different cases and varieties of right angled spherical triangles, as they depend upon the triangular pyramid V B A C. It is designed to preclude the necessity of either learning by rote or investigating the various rules and proportions connected with this branch of the subject; for by simply referring to that compartment of the table which contains the values of the quantity sought, an expression will be found denoting the precise operation to be performed for the value of the required term. Thus for example. Suppose that in the right angled spherical triangle B A C, the base $A\,C = b$, and the perpendicular $B\,A = c$ are given, and it is required to find;

1. The hypothenuse $B\,C = a$.
2. The angle $A\,B\,C = B$ contained between the hypothenuse B C and perpendicular B A, or that which is subtended by the base A C.

To find the hypothenuse $B\,C = a$, refer to that compartment of the table that contains the values of the hypothenuse, and select that expression which exhibits a combination of the given quantities b and c This is readily perceived to be No. 5, the only case in which the two given terms form an equation with the one required; hence we get

$$\text{cos.}\ a = \text{cos.}\ b\ \text{cos.}\ c.$$

And the numerical operation denoted by this expression, may, when converted into words, be read in the following manner:—

Multiply the natural cosine of the given base, by the natural cosine of the given perpendicular, and the product will give the natural cosine of the hypothenuse.

The multiplication of trigonometrical quantities is however a very laborious process, unless the contracted method of decimal multiplication is resorted to; and since very few of our practical mechanics have taken the trouble to familiarize themselves with the application of that method, the necessity of employing it may be entirely superseded by the use of logarithms. The rule will then be as follows:—

Add together the logarithmic cosines of the given parts, and the sum will be the logarithmic cosine of the part required.

NOTE.—The reader is supposed to have a previous knowledge of the trigonometrical definitions, logarithmic tables, and algebraic notation.

The general application of the table may be described in words at length in the following manner:—

Add together the logarithms of the two given quantities according to their names in the equation, and the sum will give the logarithm of the required quantity according to its name in the particular combination employed, observing always to abate 10 *in the index of the resulting logarithm.*

Again, to find the angle ABC = B, contained between the hypothenuse and perpendicular, we have only to refer to that compartment of the table containing the values of B, and to select the combination which involves the given quantities; in this case it is No. 4, from which we have

$$\tan. B = \tan. b \operatorname{cosec} c;$$

an equation which is readily reduced by the general rule given above.

In reference to the arrangement of the table, it may be remarked that it forms a right angled triangle, the same as the figure under consideration, and the squares or compartments containing the values of the several parts, are placed in the same positions with respect to each other as the parts are whose values they contain. Thus, in the figure BAC, the hypothenuse *a* occurs between the angles B and C; so in the table, the square containing the values of the hypothenuse, is placed in a diagonal direction between the squares containing the values of the angles B and C.

In the figure the perpendicular *c* occurs between the angle B and the right angle at A; so in the table, the square containing the values of the perpendicular, occurs between the square containing the values of B, and the blank square for the right angle where no value enters.

Finally, in the figure, the base *b* falls between the angle C and the right angle at A: so in the table, the square containing the values of the base, is placed between the blank square for the right angle and the square containing the values of the angle C; an arrangement which is beautifully adapted for the purpose of a speedy reference.

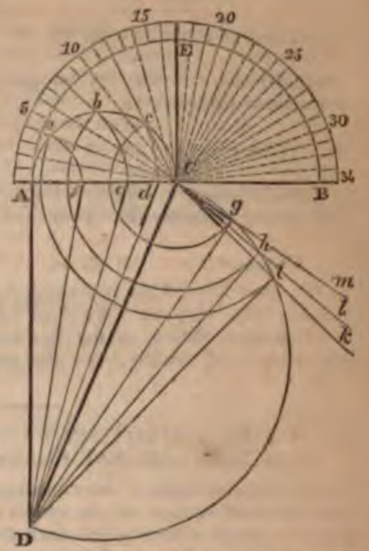
The two equations that we have selected from the table, are those which apply to the determination of the bevels for the several voussoirs throughout the whole extent of the arch. The first determines the form of the beds, or the angle contained between the joints in the face of the arch, and the corresponding joints along the soffit; and the second determines the angles contained between the face of the arch and the beds of the several courses. The application of which we now proceed to illustrate by means of an example.

Suppose a semicircular arch of 30 feet span, and consisting of 34 courses from impost to impost, to be built upon an obliquity of 68 degrees with the abutments, what are the several bevels required for the construction of the arch stones or voussoirs in each of the courses?

Since the arch is a semicircle of 30 feet span and consisting of 34 courses, that is, 17 courses between the crown of the arch and each of the imposts; it follows, that each voussoir occupies $5^\circ\ 17'\ 38''\ \frac{14}{17}$ of the circumference, having a soffit or intrados of 2·795 feet very nearly; consequently, the successive portions of the circumference, estimated from the impost to each of the beds or coursing joints as far as the crown or middle of the keystone, are respectively as in the following tablet.

COURSES.	°	′	″	COURSES.	°	′	″
1st	5	17	$38\frac{14}{17}$	9th	47	38	$49\frac{7}{17}$
2nd	10	35	$17\frac{11}{17}$	10th	52	56	$28\frac{4}{17}$
3rd	15	52	$51\frac{8}{17}$	11th	58	14	$7\frac{1}{17}$
4th	21	10	$35\frac{5}{17}$	12th	63	31	$45\frac{15}{17}$
5th	26	28	$14\frac{2}{17}$	13th	68	49	$24\frac{12}{17}$
6th	31	45	$52\frac{16}{17}$	14th	74	7	$3\frac{9}{17}$
7th	37	3	$31\frac{13}{17}$	15th	79	24	$42\frac{6}{17}$
8th	42	21	$10\frac{10}{17}$	16th	84	42	$21\frac{3}{17}$

The 17th course, or course at the crown of the arch, corresponding an angle of 90 degrees as it ought to do, when the keystone is in two parts, as we have assumed it to be in the present instance, for the express purpose of showing the influence of the obliquity upon the bevels in that course. From these angles therefore, with the constant obliquity of 68 degrees, we derive the following construction for the case in question.



Let AEB in the subjoined drawing, represent the elevation of the given semicircular arch, of which C is the centre, and AB the span or diameter. At the centre C, make the angle ACD equal to 68 degrees the given obliquity, so that CD shall coincide with the axis of the arch, and point out the direction of the abutments to which it is parallel. From the beginning of the arch at A, set off successively the values of several arcs in the tables corresponding to the respective number of courses estimated from the impost at A to the crown of the arch at E, and from thence in a retrograde order to the other impost at B.

Upon AC the radius of the arch describe the semicircle A *a b c* C, intersecting the radii C 4, C 8 and C 12 respectively in the points *a*, *b* and *c*, and at A erect the perpendicular AD meeting CD the axis of the arch in D.

About A as a centre, with the distances A *a*, A *b* and A *c*, describe the arcs *a f*, *b e* and *c d*, meeting the radius AC in the points *f*, *e* and *d* respectively, and draw the straight lines D *f*, D *e* and D *d*: then are the angles A *f* D, A *e* D and A *d* D or their supplements, the angles contained between the face of the arch and the planes of the coursing joints at the 4th, 8th and 12th courses, or at the corresponding divisions on the opposite side of the arch. These are the angles corresponding to the letter B in the figure of the table of formulæ, and if they are respectively taken in the compasses and applied to a scale of chords, they will be found to indicate 81° 41′ 46″, 74° 46′ 25″ and 70° 6′ 59″.

Upon the straight line CD as a diameter describe the semicircle C *g h i* D, in which lay off the distances C *i*, C *h* and C *g* respectively equal to C *a*, C *b* and C *c*; then will the angles DC *k*, DC *l* and DC *m* or their supplements, be the bevels of the beds or coursing joints at the 4th, 8th and 12th divisions, or at the corresponding divisions on the opposite side of the arch; the bevels in the two cases being constantly the supplements of each other.

The angles just determined from the last step of the construction, are those which are measured by the arc *a* in the tabular figure, and if they are severally taken in the compasses and applied to a scale of chords, they will be found to indicate 69° 33′ 17″, 73° 55′ 12″ and 80° 23′ 16″ respectively, for the bevels in the beds or coursing joints corresponding to the 4th, 8th and 12th divisions of the arch.

The values of B, or the bevels between the face of the arch and the planes of the coursing joints at the specified divisions of the arch, are also determined from the 4th formula in that compartment of the table containing the values of B. Thus we have tan. B = tan. *b* cosec *c*, and taking the parts of the circumference at the respective divisions, we get as follows:

	°	′	″			
4th division	21	10	$35\frac{5}{17}$	- - -	log. cosec.	0·442204
Value of *b* =	68	0	0	constant obliquity	log. tan.	0·393590
Value of B =	81	41	46	- - - -	log. tan.	0·835794
	°	′	″			
8th division	42	21	$10\frac{10}{17}$	- - -	log. cosec.	0·171538
Value of *b* =	68	0	0	constant obliquity	log. tan.	0.393590
Value of B =	74	46	25	- - - -	log. tan.	0.565128
	°	′	″			
12th division	63	31	$45\frac{}{17}$	- - -	log. cosec.	0·048098
Value of *b* =	68	0	0	constant obliquity	log. tan.	0·393590
Value of B =	70	6	59	- - - -	log. tan.	0·441688

For the values of *a*, or the bevels in the planes of the beds or coursing joints, the formula is cos. *a* = cos. *b* cos. *c*; and the operation is as follows:—

	°	′	″		
4th division	21	10	35 $\frac{4}{17}$	log. cos.	9·969637
Constant obliquity	68	0	0	log. cos.	9·573575
Value of *a* =	69	33	17	log. cos.	9·543212
8th division	42	21	10 $\frac{8}{17}$	log. cos.	9·868651
Constant obliquity	68	0	0	log. cos.	9·573575
Value of *a* =	73	55	42	log. cos.	9.442226
12th division	63	31	45 $\frac{12}{17}$	log. cos.	9·649080
Constant obliquity	68	0	0	log. cos.	9·573575
Value of *a* =	80	23	16	log. cos.	9·222655

We have limited the preceding construction and calculation to three courses only; this we have done for the purpose of saving room and preventing confusion in the figure; but from what has been effected, the reader will readily trace the method of procedure in any other case.

PROPOSED EMPLOYMENT OF VIBRATING CYLINDERS FOR THE LARGEST CLASS OF MARINE ENGINES.

The compact form of the vibrating cylinder engine, its light weight, and the small section of the vessel which it occupies, together with the advantage of having the strain from the thrust or pull of the piston entirely within its own framing, and not partially transferred to the kelsons of the vessel, as is the case in the beam engine; seem to point it out as peculiarly applicable to steam navigation, and especially to those gigantic efforts which are now making to extend our intercourse with distant countries, where the advantage of having large power in small space cannot be too highly appreciated, as the various efforts of the most celebrated makers to effect that object sufficiently testify.

Various reasons however have been assigned why this form of engine should not succeed on a large scale, and these I shall endeavour to notice and refute.

1st. The great weight of the valve casing and slide on one side has been objected to as destroying the equilibrium of the cylinder, and wearing the cylinder and stuffing box unequally.

2d. The difficulty of casting the cylinder and hollow gudgeons sound, and the impossibility of repairing them in case of a failure.

3d. The disadvantage of passing the steam through the gudgeons at all, owing to the heat occasioning an unnecessary friction.

4th. The loss of power in communicating a vibrating motion to such a large body as the cylinder. And lastly, the difficulty of packing.

Now if the above named objections can be got over, which I think there will be little difficulty in doing, we shall then have an engine free from all the disadvantages of increased friction and short connecting rods; more compact in its form, and less exposed above the water line than any yet before the public, and consequently more eligible for the purpose of commerce or war.

To get rid then of the first objection, I propose to dispense with the slide altogether, and to substitute in its place four double-beat valves as used in the Cornish engines; one top and bottom of the cylinder on either side, two being steam and two exhaustion valves.

I conceive there are many advantages to be derived from this form and arrangement of the valves. Thus, the steam valves would also serve as expansion valves, as being independent of the others there would be no difficulty in shutting them at any point of the up or down stroke of the piston, affording us the opportunity of so adjusting them, as to avail ourselves to any desired extent of the principle of expansion. The exhaustion valves would have the same facility of adjustment, so that we should be enabled to open and shut the passage to the condenser at the point which would ensure the most effective working of the engine; such valves also afford great facility of repair; with the additional advantage of one man being able to handle both engines, although the cylinders were ten feet diameter, as such valves being almost balanced, lift or open, with the slightest exertion.

2d. I would cast the gudgeons on a separate circular frame, just large enough to encircle the cylinder and to which the cylinder should be securely bolted by a strong projecting flange; this would occupy a very little additional breadth, and would entirely get over that difficulty.

3rd. I do not know that passing the steam through the gudgeons is a serious evil, but at all events it can be very easily obviated.

Let the joint and stuff box be placed on the end of the gudgeon as usual, so as to be concentric and firmly secured, and let a flat pipe be carried up till sufficiently clear of the plummer-block cover, and then bent over and secured to the body of the cylinder, when it can be easily connected with either set of valves; by this arrangement the steam does not pass through the gudgeons at all.

4th. This I have often heard urged as an insuperable obstacle to the successful application of this form of engine, but when we consider that the working beams, crossheads, &c., in almost every case exceed the weight of the cylinder—further that the beams, crossheads, &c., must in all cases move through twice the space, and in many cases through three times the space of the vibrating cylinder for the same length of stroke, it will then appear plainly that this objection has no foundation, the loss of power from the same cause being evidently less than in a common engine.

The last objection, viz., the difficulty of packing, seems scarcely worth notice, as it has been perfectly overcome in numerous boats now running.

The stuffing box ought to be considerably deeper than in common engines, and the piston rod somewhat stronger.

The air pump, feed and bilge pumps can be easily worked from the intermediate shaft, as frequently done. But I should greatly prefer having a separate steam cylinder to work all those pumps, working in connection with and at pleasure, detachable from the main cylinders, this would get rid of the crank or eccentric on the intermediate shaft, which is to a certain degree objectionable. It might be so arranged as to be quite out of the reach of shot, and would not occupy any additional space on the floor of the vessel beyond that occupied by the engine framing; the following striking advantages wou'd accrue from this arrangement; we should be enabled to keep up the steam and preserve s vacuum for any length of time, so as to start at a moment's notice; and secondly, what I consider of far greater importance, the turn of a cock, or opening of a valve might convert the air pump into an immense bilge pump, with an available power to work it, and sufficient to keep the vessel clear under almost any circumstances. The additional security to the shipowners, and safety to the passengers, which this would ensure in case of the vessel taking ground, or in other circumstances when it might be inconvenient or impossible to work the engines, cannot be too highly estimated; and I have no doubt there are many naval men who at one time or other would gladly have availed themselves of such a power. But if this arrangement be considered too decided an innovation, they can be worked in the usual manner.

In conclusion, I see no difficulty in the manufacture, nor any reason to adprehend a failure; and as such an engine would occupy not more than half the space of a common beam engine, would weigh very considerably less, and would, as before mentioned, be free from all the disadvantages of increased friction or short connecting rods, with the advantage of being less exposed above the water line; and lastly, could be made for quite as little, if not less expense; it is well worthy of the attention of the heads of our naval establishment, and of steam boat proprietors in general, and if there be any thing against it which I have overlooked, perhaps some of your numerous correspondents could point out where the fault lies.

A. S.

Pimlico, March 17, 1840.

TABLE OF ARCHITECTS WHO HAVE DIED IN THE 18th AND 19th CENTURIES.

By W. H. Leeds.

Imperfect as the following Table is, *in tenui labor* might be its motto, since the drawing it up has cost far more pains and research than it ought to have done, or would have done, had not architectural biography been notoriously slighted. Relative to Italian architects and a few others of preceding periods, information may be met with in general biographical works, because the materials for such articles are abundantly supplied by Vasari, Baldinucci, and other writers of that class; but, with here and there an exception, such biography becomes more and more meagre, precisely when it might be expected to be more copious and satisfactory, namely, as we approach our own times. Not having the original work by Milizia to refer to, I do not precisely know which are the "Additional Lives," inserted by his English translator, but it certainly does not say much for either the diligence or judgment shown by her, when we find such names as those of Langhans, Antoine, and Ledoux omitted, while such a person as Joel Johnson, is deemed worthy of notice. The appendix to Quatremère de Quincy's "Vies des Architectes," gives a few notices of architects who lived in the two last centuries, yet in only one or two instances is there a date of any kind, which is certainly a more original than laudable mode of treating biography and history. Even Nagler's work, which professes to give notices of both living and deceased artists of every class, and which, when completed, will contain several thousand articles, makes no mention of Giuseppe Marvuglia, the architect of the beautiful Oratorio dell'Olivella, at Palermo, (given in Zanth and Hittorff's Archit. Mod. de la Sicile), nor have I been able to discover elsewhere any further mention of him, consequently, have no clue to even an approximating date for the time of his death. Though his journey was professedly an architectural one, Woods does not even mention the building at all; and indeed, as far as recent Italian architecture is concerned, the art might be supposed to be now altogether extinct in that country, judging from the dogged silence of all our later travellers and tourists in regard to it, for though some of them bore us with common Guide-book remarks on Palladio, scarcely one of them appears to have been aware of the existence of a Marvuglia, a Calderari, or a Cagnola, or of such living nobodies as Buonsignore, Bianchi, Canonica, Canina, and—not to go through the whole alphabet, numerous others, whose names ought now to be tolerably familiar to us here at home—at least to those engaged in architectural studies, and caring to be *au courant du jour* in the history of the art. What is still more extraordinary is, that where buildings are noticed, or even fully described as in Förster's Bauzeitung, there is frequently not either date or architect's name to assist the future historian.

As far as it goes, the present table affords a chronological synopsis that may be useful for reference, and for occasionally refreshing the memory. A similar one of buildings erected within the same period, might be drawn up as an accompaniment to, or skeleton of, architectural history during the last and present century; but it would be greatly more extensive, and in fact, there ought to be a separate table of the kind for each country. In the meanwhile, I am content to offer this specimen, and should any correspondent be able to suggest any additions, or fix any dates here left in uncertainty, I should feel obliged by his doing so.

CHRONOLOGICAL TABLE OF ARCHITECTS WHO DIED IN THE 18TH AND 19TH CENTURIES.

WHERE the precise date of an architect's death could not be ascertained, it is indicated by *ab.* (about). An asterish * is prefixed to the names of those who have distinguished themselves, not as architects, but as writers on architecture, &c. The names of places in Italics denote that the architect was chiefly employed there.

DIED.	NAME.	BORN.	WORKS.
1702	Bruce, Sir W.	..	Hopetown House, &c., Scotland.
1708	Mansard, J. Hardouin,	1747	
1714	Fontana, Carlo,	..	Palazzo di Monte Citorio, Palazzi Grimani, Bolognetti, &c., Rome.
	Schlüter, Andreas	1662	Sculpt. and Archit. The Dom, &c., Berlin. *Potzdam, St. Petersburgh.*
	Cayart, Louis	..	French Church, &c., Berlin.
1723	Wren, Sir Chr.	1632	St. Paul's; parts of Greenwich Hospital, &c. &c.
	Eosander, Joh. Fried., Baron von Goethe,	..	Monbijou, La Favorite, Charlottenburg, &c.
1724	Fischer von Erlach, Baron,	1650	Many churches and palaces, *Vienna.*
1725	Churriguera, Josef,	..	Celebrated as being the Borromini of Spain.
1726	Ardemans, Theod.	1664	*Aranjuez, Madrid.*
1727	Sir J. Vanbrugh,	1666	Blenheim, Castle Howard, parts of Greenwich Hospital, &c.
1728	Desgodets, Ant.	1653	"Antiq. of Rome."
1734	Campbell, Colin,	..	Wanstead House, Mereworth. "Vitruvius Britannicus."
1735	Cotte, Robert de,	1657	Chateau d'Eau, Hotel Toulouse, Façade of St. Roche, Paris.
1736	Juvara, Filippo,	1685	San Ildefonso, &c. *Lisbon.*
	Hawksmoor, Nich.	1666	St. Mary Woolnoth's, St. George's, Bloomsbury.
	Clarke, Dr. Geo.	1660	Library Christ Church, Oxford.
1737	Galilei, Alex.	1691	Corsini Chapel, &c. Rome.
1739	Galli da Bibiena, Fran.	1659	Theatre, Verona; Ditto, Vienna. "Architettura Maestra dell'Arti."
1740	Grahl, Joh. Fried.	1703	Several churches, mansions, &c., Berlin.
	Gabrielli, Gabriel,	1671	*Vienna, Eichstadt*, &c.
	Fischer von Erlach, Baron,	1680	*Vienna.*
1742	Gabriel, Jacques,	1667	*Bordeaux, Rennes, Paris.*
	James, John,	..	St. George's, Hanover Square.
1745	Bodt, Johann. de	1670	*Dresden.*
1746	Leoni, Giacomo,	..	Lyme Hall.
1747	Förster, —	..	*St. Petersburg, Cronstadt, Tzarkoeselo.* Edit. "Palladio."
1748	Kent, W.	1685	Holkham, Horse Guards, &c. Edit. "Inigo Jones' Designs."
	Gerlach, Phil.	1679	Buildings at Berlin and Potzdam.
1751	Salvi, Nicolo,	1699	Fountain of Trevi, Rome.
1752	Dintzenhofer, K. I.	1690	*Vienna;* several public buildiugs at Prague.
1753	Earl of Burlington,	..	Chiswick House; Assembly Rooms, York, &c.
	Baron von Knobelsdorff,	1697	Opera House Berlin. *Potsdam, Charlottenburg.*
1754	Gibbs, James,	1683	St. Martin's; Radcliffe Library, Oxford, &c.
	Wood, John,	..	Circus, Crescent, &c., Bath.
	Boffrand, Germ. de,	1673	*Paris, Nancy, Luneville.* "Principes d'Architecture."
1756	Villanueva, Diego,	..	*Madrid.* "Cartas Criticas," 1766.
1758	Ripley, Thomas,	..	Houghton Hall, Admiralty.
1759	Bonavia, Santiago,	..	*Aranjuez, Madrid.*
	Kleiner, Salomon,	1703	Designs and Engravings.
1760	Carlier, Fran.	..	Monastery de las Salesas, Madrid.
1762	Labelye, Charles,	..	Westminster Bridge.
ab.	Alfieri, Count Benedetto,	..	Opera House, and Teatro Carignano, Turin, &c.
1764	Sacchetti, Giambattista,	..	Royal Palace, Madrid.
	Murena, Carlo,	1713	*Rome*, &c.
	Burroughs, Sir James,	..	Senate House, Cambridge.
1766	Servandoni, Niccola,	1695	Façade of St. Sulpice, Paris.
	Ware, Isaac,	..	Footscray, &c. Edited "Palladio."
	Teodoli, Marq. Giacomo,	1677	Teatro Argentina, &c., Rome.
1767	Rubio, Felipe,	..	Custom House, Valencia, &c.
1768	Couvillier, Fran.	1698	Façade St. Cajetan's, &c., Munich.
	Dance, George,	..	Mansion House.
1771	*Woods, Robert,	1716	"Ruins of Palmyra."
	Zoccoli, Carlo,	1718	Cathedral, &c. Calvi; *Cutignano, Portici, &c.*

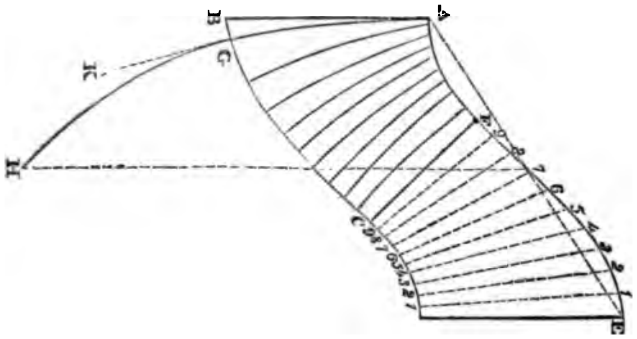
DIED.	NAME.	BORN.	WORKS.
	Kakorinov, Alex.	..	Academy of Arts, St. Petersburg, &c.
1772	Vanvitelli, Luigi,	..	Palace at Caserta, &c.
	Pompei, Count Alessandro,	..	Several palazzi at Verona; villa at Illasi.
1773	Blondel, Jacq. Fran.	1705	*Metz*, *Strasbourg*, *Cambray*. "Cours d'Archit." 9 vols.
1774	Preti, Franc. Maria,	1701	S. Liberale, &c., Castel Franco. "Elementi dell'Architettura."
	Galli da Bibiena, Anton.	..	Theatre at Bologna, &c.
1776	Boumann, Joh.	1706	Prince Henry's Palace, Catholic Church, &c., Berlin.
	Posi, Paolo,	1708	Palazzi Sergardi, and Bianchi, Sienna.
1777	Contant d'Ivry,	..	Began the Madelaine, Paris.
1778	Piranesi, Giamb.	1721	The complete collection of his Arch. Designs and Engravings, 15 vols. folio.
1779	Miazzi, Giov.	1699	S. Giambattista, Bassano, &c.
1780	Soufflot, Jacq. Germain,	1714	Pantheon at Paris.
	Fuga, Ferdinando,	1699	Palazzo Corsini, &c., Rome, *Naples*, &c.
1781	Simonetti, M. Aug.	..	The Museo Pio-Clementino in the Vatican.
	SCHINKEL, Karl Frederick,		
1782	Gabriel, J. A.	1710	Ecole Militaire,and Gardemeubles, Paris.
	Marquet, J,	..	*Aranjuez*, *Madrid*.
1783	Brown, Lancelot,	1716	Landscape Gard. and Architect. Claremont, &c. &c.
1784	Dieterichs, Fried. Wilhelm,	1702	Orangery, Potsdam; buildings at Berlin.
	*Essex, James,	1723	Several Essays relative to Gothic Architecture.
1785	Rodriguez, Ventura,	1717	The most celebrated of all modern Spanish architects: designed or executed an imme number of works.
	Peyre, M. Jos.	1730	One of the regenerators of French architecture. Odeon, Paris, &c.
1786	Fernandez, Miguel	..	Church and Convent de Montesa, Valencia.
1788	Stuart, James,	1713	"Antiquities of Athens." Chapel, Greenwich Hospital.
	Sir Robert Taylor,	1714	Parts of Bank of England.
ab.	Gontard, Carl von,	1738	*Berlin*, *Potsdam*, &c.
1789	Starov,	..	The Tauridan Palace, Church of the Alex. Newsky Convent, St. Petersburgh, &c.
	Paine, James,	1716	Mansion House, Doncaster; Wardour Castle; Worksop; Designs published.
	Temanza, Tommaso,	1705	Maddalena, Venice. "Lives of the Venetian Architects." 2 vols. 4to. 1777.
1790	Krubsacius, Fred. Aug.	1718	*Dresden*.
ab.	Knobel, Joh. Fried.	1724	*Warsaw*, *Grodno*, &c.
ab.	Boumann, Joh. Fried.	1737	Royal Library, Berlin; Theatre, Schwedt, &c.
1792	Adam, Rob.	1728	Register Office, &c., Edinburgh: Adelphi; Designs published.
	Gilabert, Ant.	1716	*Valencia*.
	*Ponz, Antonio,	1725	His "Viage de Espaha," 18 vols., abounds with materials for history of Spanish architectu
	*Moreno, Josef,	1748	"Viage a Constantinopla," &c.
1793	Sabatini, Franc.	1722	*Madrid*, *Aranjuez*, &c.
1794	Roncalli, Count,	1729	Custom-house, &c., Barcelona.
	Jean Radolphe,		
	Perronet,	1708	Bridges at Neuilly, Mantes, Orleans, &c.
	Rodriguez, B. B.,	1736	*Madrid*, &c.
	Garcia, Josef,	1760	*Valencia*, &c.
1796	Sir W. Chambers,	1725	Somerset House; Buildings in Kew Gardens, &c. "Treatise on Civil Architecture."
1797	Duran, Ramon,	1760	*Madrid*, *Salamanca*, &c.
1798	De Wailly, Charles,	1729	Odeon at Paris; Saloon in Palazzo Serra, Genoa, &c.
	Gonsalez, Man. Reguera,	1731	Numerous buildings at Oviedo.
ab.	Cerati, Domenico,	..	New Hospital, Specola, and several Palazzi at Padua.
	*Milizia, Francisco,	1725	"Archit. Civile." "Vite degli Architetti, &c."
1799	Bazhenov, Vassil Ivanovitch,	1737	Mikhaelovsky Palace, &c., St. Petersburgh, Cronstadt, &c.
	Jardin, Nich. Hen.	1720	*Copenhagen*.
	Harsdorf,	1735	*Copenhagen*.
	*Weinlig	..	*Dresden*.
	Conture, Guill.	1732	La Madeleine, Paris, 1777-93.
1800	Sanchez, Franc.	1737	*Madrid*, *Minorca*, &c.
	Erdmannsdorff, Baron Fr. Willh.	1736	Villa and Gardens, Wörlitz, &c.
	Tomas, Domingo de,	..	*Granada*. Finished the Façade of the Cathedral, Cadiz, &c.
	Louis	..	Theatre at Bordeaux, &c.
			NINETEENTH CENTURY.
1801	Antoine, Jacques Denis,	1733	The Mint, Paris; ditto at Bern, &c.
	Sanz, Augustin,	1724	Santa Cruz, &c., *Zaragoza*.
1802	Gontard, Carl,	1738	*Berlin*, *Potsdam*, &c.
	Ivanov, Alexeivitch,	1760	*St. Petersburg*.
1803	Volkhov, Phedor Ivanovitch,	..	Tauridan Palace, &c., St. Petersburgh.
	Leroi, Dav.	1736	"Monumens de la Gréce."
1804	Calderari, Ottone,	1730	Several Palazzi, &c., at Vicenza. Designs published.
	Delagardette, C. M.	..	"Ruines de Pœstum." "Nouveau Vignole," &c.
	Revett, Nicholas,	1722	"Antiquities of Athens," with Stuart.
1805	Arnal, Juan Pedro,	1735	*Madrid*.
1806	Ledoux, Claude Nicholas,	1736	Barrieres at Paris, Hotel Thelusson, &c.
	Pollak, Leopoldo,	..	*Milan*, *Trieste*, &c.
	Holland, Henry,	1746	Carlton House, Old Drury Lane Theatre, &c.
	Renard,	1748	*Paris*.
1807	Mangin, Charles,	1721	*Paris*, &c.
	Carr, John,	1721	Harewood House, Yorkshire; Mausoleum at Wentworth, &c.
	Detournelle, Athanasius,	1766	"Grands Prix d'Archit." "Projets d'Archit."
1808	Bonomi, Joseph,	1739	Roseneath; alterations at Keddlestone, &c.

DIED.	NAME.	BORN.	WORKS.
1808	Piermarini, Giuseppe,	..	Teatro della Scala Milan, &c.
	*Gilly, David,	1745	Several works on Building and Architecture.
	Legrand, Jacq. Guill.	1743	Theatre Feydean, Paris. Many architectural works, &c.
	Langhans, C. G.	1733	Brandenburg Gate, &c., Berlin.
1809	Lechner, Joh. Bapt.	1758	*Munich.*
	Gebhard, J. Aug.	1735	*Dresden*, &c.
1810	Fischer, R. F. H,	1745	*Stuttgart, Hohenheim, Scharnhausen*, &c.
ab.	Dubut, L. A.	..	"Architecture Civile."
	Chalgrin, J. F. T.	1739	St. Philippe du Roule, Arch L'Etoile, &c., Paris.
1811	Genz, Heinrich,	..	Mint, Berlin, &c.
	Villanueva, Juan de,	1739	Teatro del Principe, Museum, Observatory, &c., Madrid.
	Mylne, Rob.	1734	Blackfriars' Bridge, Inverary Castle, &c.
1813	Brogniart,	..	Lycée Bourbon, Bourse, &c., Paris.
	Wyatt, Jas.	1746	Pantheon, Fonthill, Ashridge, &c. &c.
	Thomond, Thos.	1759	Great Theatre, and Exchange, St. Petersburgh.
	Gerstenberg, J. Lor. Jul.	..	
	*Houel, Jean,	1735	"Voyage Pittoresque en Sicile," 4 vols. folio, &c.
1814	Voronikhin And, Nik.	1760	The Kazan Cathedral, St. Petersburgh.
1816	Hardmuth, Joseph,	1752	Lichtenstein Palace, Vienna, &c. &c.
	Bianzani, Luige,	1756	Palazzi Fadigati and Cuti, Casal Maggiore: Church, Comasaggio; Villa Ala Ponzoni, Borgolieto, &c.
1817	Zanoja, Ginseppe,	..	Porta Nuova, Milan, &c.
	Quarenghi, Cav. Giacomo,	1744	*St. Petersburg, Tzarskoeselo.*
	Vici, Andrea,	1743	*Naples.*
1818	Dufourny, Leon, *ab.*	1760	Botanic School, Palermo, &c.
	Gondouin, Jacques,	1737	Ecole de Medecine, Paris.
	Selva, Antonio,	..	Teatro della Fenice, Venice.
1819	Catel, Ludwig,	..	Welpersche Badehaus; Orangery, Pankow; Decorations, Palace at Weimar. Several Architectural publications.
1820	Fischer, Karl,	1782	Theatre, &c., Munich.
	*Clerisseau, Chas. Louis,	1721	"Antiquités de Nismes," &c. &c.
1821	Rennie, John,	1761	Waterloo Bridge, &c.
1822	Damesme, Louis Em. Aimé,	1757	Theatre Olympique, &c., Paris.
	Giesel, J. Aug.	1751	*Dresden.*
1823	Porden, W.	..	Stables at Pavilion, Brighton; Eaton Hall, Cheshire.
	Rodriguez, M. Mart.	1746	*Madrid, Malaga, Salamanca.*
	*Genelli, Hans Christ,	..	Several publications on Architecture and Antiquities.
1824	Donnat, Jacques,	1745	Place Peyron, Toulouse; Allais Cathedral, &c.
	Hurtout,	1751	Restorations at Fontainbleau.
	Khumel,	..	Cathedral at Gran, Hungary.
	*Tappe, Wilh.	..	Writings on Architecture.
1825	Perez, Silvestre,	1767	*Madrid, Seville, S. Sebastian*, &c.
	Dance, George,	1741	Newgate, St. Luke's Hospital.
1826	Gandon, Jas.	..	Custom House, Exchange, Four Courts, &c., Dublin.
	Weinbrenner, Fred.	1766	Theatre, &c., Carlsruhe.
	*Friderici, Dan. Gottlob,	1767	Several publications, &c., on Architecture.
	*Mazois, Fran.	..	"Pompeii." "Palais de Scaurus," &c.
1827	Engel, Franz.	1776	*Vienna.*
1829	*Cean-Bermudez, J. Aug,	1749	"Descripcion Artistica de la Catedral de Sevilla;" "Noticia de los Arquitectos de Espana," &c.
1831	*Hope, Thos.	1770	"Household Furniture;" "Costume of the Ancients;" "History of Architecture."
	*Melling, N.	1765	"Voyage Pittoresque de Constantinople," &c.
1832	*Pugin, Augustus,	1769	"Specimens of Goth. Archit." "Examples of Goth. Arch."
	Marq. de Guerchy,	..	Theatre de Vaudeville, &c., Paris.
	Gay, J. J.	1775	Museum, &c., Lyons.
1833	Cagnola, Luigi,	1760	Arco della Pace, &c. Milan, fflc.
	Labarre,	..	Finished the Bourse, Paris.
	Thurmer, Jas.	1789	*Dresden.*
	Heigelin, Dr. K. M.	..	Prof. of Arch. Tubingen. "Lehrbuch der Höheren Baukunst," &c.
1834	*Cicognara, Count,	1767	"Fabbriche di Venezia." "Storia della Scultura," &c.
	Telford, Thomas,	1755	"Architecture," Brewster's Encyclopædia.
1835	Durand, J. Nic. Louis,	1760	"Leçons d'Architecture," &c.; "Paralléle."
	Nash, John,	..	Buckingham Palace; Pavilion, Brighton, &c.
	Goodwin, F.	1780	Town Hall, Manchester.
	Dufour, Alex.	1760	Restorations, &c., at Versailles.
1836	Heger, Franz.	1792	*Darmstadt.*
	*Stieglitz, Dr. Chr. Ludwig,	1756	"Hist. of Architecture," &c.
ab	Alavoine, —	..	July Column, Paris.
1837	Soane, Sir John,	1753	Bank of England, Board of Trade, &c.
	*Hirt, Aloysius,	1759	"Baukunst der Alten," &c.
	*Quaglio, Dominico,	1787	Distinguished Architectural Draftsman and Painter. Restored Schloss Hohenschwangen.
1838	Percier, Chas.	..	Arch. of the Tuileries. Restorations, &c., at Louvre and Tuilleries. Chapelle Expiatoire. "Recueil de Decorations," &c.
1839	*Landriani, Paulo,	1757	Scene-painter and Architect. "Treatise on Theatres."
	Ohlmuller, Daniel-Jos.	1791	Gothic Church, St. Maria Hilf, Munich.
	Valadier.	..	
	Wilkins, W.	..	Downing College, Cambridge; London University; National Gallery, &c.
1840	Wyattville, Sir Jeffrey,	1766	Additions at Windsor Castle.
	Albertolli, Giocondo,	1742	Still living in 1837. Villa Melzi, Bellagio; *Milan*, &c.

SKEW ARCHES.

Sir,—I am surprised that among the many correspondents who address you, there are so few of them either theoretical or practical, who touch upon the subject of skew arches, a subject which presents so wide a field of observation and remark.

Among the very few works which we possess on this point, Mr. Buck's seems to hold the highest place, although even in it there seems to me several things which would be the better for alteration or amendment. Although he is particular in giving the mathematical formula for calculating the necessary angles and lines, yet he assumes some things, as granted, which lie at the very foundation of his principles; for example, he observes that the lines of the courses of the intrados should be made perpendicular to a line drawn between the extremities of the developement of the face of the arch, without ever giving any reason for it, or making any remark on the subject, farther than that it should be so. Now it strikes me that a considerable alteration may be made in this for the better. Let A B C D E F (in the figure annexed) be the developement of a semicircular arch, then there is a curve A G H, such that a tangent drawn from any point in this curve is perpendicular to the face of the arch at the said point, as, the tangent G K, drawn from the point G is perpendicular to the developement of the face of the arch B, G C, at the said point G. Now if the courses were drawn similarly to this as shown in that part of the figure A, B, C, F, then the arch (according to Mr. Buck, in the beginning of his seventh chapter) would be perfectly secure. Unfortunately however, the difficulty of execution would be so great, if it is not an impossibility, that this could never be applied vigorously to practice, and the only way left is to make the best practicable approximation to this curve. There are two methods, either of which appear to me to be better than that of Mr. Buck's, although the first has a considerable drawback, because the beauty of the arch is very much destroyed on account of the unequal divisions of the courses. The first method is after having drawn a line as F C perpendicular to the face of the arch at the centre, to divide the segments F E, and C D into an equal convenient number of parts, and to draw the courses as shown by dotted lines from the one face to the other through the respective points 1, 1—2, 2—3, 3, &c. This, although a little more expensive than the common method, appears to me more desirable on account of the additional strength which it possesses. I may mention that I was shown a model built upon this principle, which when subjected to a pressure on the crown, forced the abutments asunder exactly in the line of the face of the arch, thus giving the best proof of the correctness of the principle. The second method which I would recommend is simply instead of drawing the line of the intradosal courses perpendicular to the straight line A E, to draw it nearly averaging the curve A G H, the tangent of the angle which such a line would form with the abutments approximates to $\frac{\cot\theta}{2}$. θ being the angle of the acute corner of the abutments. The advantages to be derived from this are, first that this angle being less than that commonly employed, there will be less tendency to slip, and secondly, that being more nearly perpendicular to the face of the arch, there is consequently more stability.



I am astonished at the serious errors into which Mr. Buck has fallen in his last chapter, which is devoted to *further investigations*, but which had better have been omitted altogether. In attempting to determine at what attitude above the level of the axis of the cylinder the thrust of the arch will be perpendicular to the bed of the voussoir, he gives a formula which produces the strange result that the smaller the archstone, the lower will be the said attitude, that is to say, the more secure will be the arch, and also that it will be able to be built at a more acute angle. Another still more strange phenomenon, the result of this formula, is that the greater the skew of the bridge the less of the arch will have to be supported by iron dowels and bolts; thus an arch built at an angle of 25° will require no assistance from dowels, an arch built at an angle of 55° will require to be secured by dowels to a height of 25° above the springing, and lastly, an arch of 90° or square to the abutments, will have to be secured to a height of 40° above the springing. The whole of these errors arise from having given the expression $\frac{\text{cosec.}\ \theta.\ \cos\tau}{\frac{1}{2}\pi}$ (nearly at the bottom of page 37), instead of $\frac{\cot\theta.\ \cos\tau}{\frac{1}{2}\pi} \div \text{cosine}\ (\theta + \phi)$ where ϕ is such an angle that its tangent is $= \frac{\cot\theta.\ \sin\tau.}{\frac{1}{2}\pi}$ · This must be evident to any one who considers that the courses alter their angle with regard to the face of the arch, which Mr. Buck has not taken into consideration.

As it may be of some use to settle this problem, I would submit the following solution, observing that the letters and charaters refer to the same as in Mr. Buck's treatise.

1st. In finding a term for C O, I would reject the thickness of the cylinder, and consider the point O as that to which the tangents of the small curves which show in the face of the arch, tend; this is more correct because the joints of the voussoirs being segments of curves, there can be no point on the face of the arch at which a ball would roll down the bed into a line exactly parallel to the face; this may be considered too minute for observation, but besides being more correct it will simplify the question much.

Then upon this ground C O $= \frac{\cot^2\theta}{\frac{1}{2}}$, and taking Mr. Buck's own figures at the bottom of page 37. I E K $= \frac{\cot^2\theta + \nu.\ \sin\tau}{\nu.\ \cos\tau.\ \text{cosec}\ \theta}$.

2d. In finding the tangent of the internal angle, Mr. Buck states correctly "that the tangent of the angle, which the tangent of the intradosal spiral makes with the horizon diminishes as cos. τ," but he has omitted to mention that the angle θ, which the course makes with the face at the springing, increases as a certain function of sin. τ becoming $(\theta + \phi)$, where ϕ is such an angle that it has for a tangent $\frac{\cot.\ \theta.\ \sin.\ \tau}{\frac{1}{2}\pi}$; this then would make the tangent of the internal angle at the point sought $\frac{\cot\theta.\ \cos\tau}{\frac{1}{2}\pi.\ \cos(\theta+\phi)}$, then equating these values of the external and internal angles, we have

$$\frac{\cot\theta.\ \cos\tau}{\frac{1}{2}\pi.\ \cos(\theta+\phi)} = \frac{\frac{\cot^2\theta}{\frac{1}{2}\pi} + \nu.\ \sin\tau.}{\nu.\ \cos\tau.\ \text{cosec}\ \theta}$$

but rejecting ν in the second side of the equation, because by hypothesis it is unity, and multiplying both sides by $\frac{1}{2}\pi$, cos. τ, cosec θ, we have $\frac{\cot\theta.\ \cos^2\tau}{\sin\theta.\ \cos(\theta+\phi)} = \cot^2\theta + \frac{1}{2}\pi.\ \sin\tau.$

After this the solution must be completed by a series of approximations until a true value of τ can be found. If the thickness of the archstones is wished to be considered, then by making the second side of this last equation $\cot^2\theta.\ \frac{\nu+e}{\nu} + \frac{1}{2}\pi.\ \sin\tau.$ it will give the required result, thus,

$$\tau \text{ when C O} = \frac{\cot^2\theta}{\frac{1}{2}\pi}\,\nu, \text{ or } \tau \text{ when C O} = \frac{\cot^2\theta}{\frac{1}{2}\pi}.\ \nu + e,$$

	°		°	″				°
When θ is	60	then	40	56	-	-	-	40
	45	-	42	46	-	-	-	40
	30	-	50	10	-	-	-	43

The numbers in the last column are only approximations, but it may be taken that in all arches of a moderate skew, the point τ is about 40° above the level of the axis of the cylinder.

I have merely thrown out these observations for the purpose of directing attention to this particular kind of arch, which is now come into such common use, and about which we have so little information, and that little of a very loose kind with regard to the theory of the arch, but I think that Mr. Buck is entitled to the thanks of the profession for the clearness and accuracy with which he has explained and illustrated the greater portion of the subject practically considered.

I remain, Sir, your's respectfully,

B. H. B.

Edinburgh, March, 1840.

AMERICAN STEAM BOATS.

The following comparison of the power of the engines employed in the steam boats navigating the rivers of North America and those running here on the Thames may not be uninteresting to many of our readers, particularly those who are engaged in steam navigation.

We have taken as the basis of our calculations the following particulars of the "Rochester," a steam boat plying on the river Hudson, between New York and Albany, which have been furnished by Mr. David Stevenson in his "Sketch of the Civil Engineering of North America."

The Rochester is 209 feet 10 inches in length, and 24 feet beam, the depth of her hold is 8 feet 6 inches, and she draws, with an average number of passengers, 4 feet of water. The diameter of the paddle wheels is 24 feet, and the length of the floats, which are 24 in number on each wheel, is 10 feet, and their dip, under the above circumstance, 2 feet 6 inches. The vessel is propelled by one engine, having a cylinder 43 inches in diameter, with a 10 feet stroke. The steam, which is generated under a high pressure, is cut off at half stroke, and condensed.

Under ordinary circumstances the engine is worked by steam of from 25 to 30 lbs. pressure, and in this case the piston makes about 25 double strokes per minute; but when the Rochester is pitched against another vessel, and at her full speed, the steam is often carried as high as 45 lbs. on the square inch in the boiler, and the piston then makes 27 double strokes, or in other words, moves through a space of 540 feet per minute, or 6·13 miles an hour. In this case the circumference of the paddle wheels moves at the rate of 23·13 miles an hour.

It was under these circumstances that Mr. Stevenson made a passage in this vessel, during which he informs us she attained a speed of 16·55 miles an hour, her piston then making 27 double strokes per minute, and the tide being just on the turn; by which we judge the pressure of the steam in the boiler to have been 45 lbs. on the square inch. Mr. Stevenson remarks that "at that time the vessel could not be far from having attained the maximum speed at which her engines are capable of propelling her through the water." What the precise signification of this observation may be we do not exactly comprehend: the only way in which we can account for it is either that hard firing was carried nearly to the greatest extent possible in the furnaces, or that 45 lbs. on the square inch was not far from the highest pressure which the boiler was capable of sustaining without damage.

Allowing that at this great speed the steam is wire-drawn to such a degree as to lose 4·71 lbs. of its pressure (which is a much greater loss than is probably experienced in reality), we will assume the initial pressure of the steam in the cylinder to have been (including the pressure of the atmosphere) 55 lbs. on the square inch. The relative volume of steam of this pressure is 507·3, and as it is cut off at half stroke, its mean pressure through the stroke, reckoning the waste space at the end of the cylinder at $\frac{1}{20}$ of the contents of the cylinder, was 46·47 lbs. From this must be deducted the pressure in the condenser, which Mr. Stevenson estimates at 5 lbs. per square inch. This leaves a mean effective pressure of 41·47 lbs. per square inch, which multiplied by the area of the piston, which is 1452·2 square inches, gives 60222·73 lbs. for the total effective pressure on the surface of the piston, and multiplying this by its velocity 540, and dividing by 33000, we find the gross power to be 985·463 horse power. If we considered the pressure in the condenser as a part of the load of the engine, which would be the fairest way to show the comparative merits of different engines, since it is a defect when the pressure in the condenser is considerable, we should find the gross power of the Rochester's engines to be 1104·3 horse power.

Supposing the above data to be correct, the quantity of water boiled off to supply the engine must have been 5·9041 cubic feet per minute, or 354·246 cubic feet per hour.

Considering the Rochester's midship section as a rectangle, its area cannot exceed 96 square feet, and the power employed in propelling her at any given speed must bear some proportion to that area, depending on the form of her body. The power is also admitted to vary as the cube of the velocity; therefore the total power employed in propelling a certain vessel at a given speed may be represented by the expression

$$K\,A\,V^3,$$

in which K is a coefficient depending on the form of the vessel, A the area of her immersed midship section, and V her velocity.

The Gravesend steam boat "Ruby," belonging to the Diamond Company, is 155 feet in length, and her beam 19 feet. Her draught of water with 300 passengers on board was 4 feet 4 inches forward, and 4 feet 8 inches aft, mean 4 feet 6 inches, and the area of her midship section immersed 65·6 square feet. The diameter of her paddle wheels is 17 feet 2 inches, the number of floats on each wheel 11, their length 9 feet, depth 18 inches, and their dip under the above circumstances 20 inches.

The vessel is propelled by a pair of engines of 50 horse power each. The diameter of the cylinders is 40 inches, the length of stroke 3 feet 6 inches, pressure of steam in the boilers 3½ lbs. above the atmosphere, vacuum in the condensers 28¼ inches, number of revolutions per minute 31½, and speed of the vessel 13·5 miles per hour.

The area of the two pistons taken together is 2513·28 square inches, and the effective pressure of the steam on each square inch of the pistons is 3·5 + 13·852 lbs. = 17·352 lbs. which multiplied by the area of the pistons gives the total effective pressure = 43610·43 lbs., and multiplying this by the velocity of the pistons, which is 220·5 feet, and dividing by 33000, we find the gross power = 291·4 horse power. Or, considering the pressure in the condenser as a part of the load, as we did for the Rochester, the pressure on each square inch of the pistons being 3·5 + 14·71 = 18·21 lbs., we should find the gross power = 305·81 horse power. Of this gross power, which we will call P, a certain portion is employed in overcoming the friction of the engine and the resistance of the steam in the condenser, owing to the vacuum not being perfect; and we may assume this portion, in engines of the same construction and working on the same system, to bear a constant proportion to the gross power P. The remainder, which is employed solely in propelling the vessel, may therefore be represented by the expression $k\,P$, in which k is a constant coefficient.

We have shown above that this quantity may also be represented by

$$K'\,A'\,V'^3,$$

K' being the coefficient of resistance of the Ruby, A' her immersed midship section, and V' her velocity. We must therefore have

$$k\,P = K'\,A'\,V'^3.$$

If P' be the gross power required to propel a vessel of the same form as the Ruby, but whose midship section immersed is equal to that of the Rochester, or A, at the velocity V, which is that of the Rochester, we shall have

$$k\,P' = k\,P\,\frac{A\,V^3}{A'V'^3},$$

or

$$P' = P\,\frac{A\,V^3}{A'V'^3}.$$

Substituting the values of all the known quantities, we obtain

$$P' = 305{\cdot}81\,\frac{96 \times 16{\cdot}55^3}{65{\cdot}6 \times 13{\cdot}5^3} = 824{\cdot}54,$$

which is less than three quarters of the gross power of the Rochester's engine.

The effective power of the Ruby's engines, that is, the power applied to the paddle wheels, calculated from the resistance to the floats by Mr. Mornay's method given in Tredgold's Treatise on the steam engine, page 132 of the Appendix, but with double the coefficient, (Mr. Mornay having found since the publication of the above mentioned work, that the resistance to a body moving through a fluid should be double what the generally received theory makes it), is found to be equal to 267·86 horse power; but if we calculate their effective power by M. de Pambour's rule, which is to deduct from the effective pressure on the piston first 1 lb. per square inch for the friction without load, and then one-eighth of the remainder for the friction due to the load, we find only 240·285. The two methods would, however, give precisely the same result if the pressure in the boiler were 5·38 lbs. above the atmosphere; but it is probable there are some inaccuracies in the data of both calculations, and the discrepancy is not very great, the ratio of the two numbers obtained being very nearly 9 : 10. However, to give the Americans the advantage of every doubt, we will assume the pressure in the boilers to have been 5 lbs. on the square inch. (It would be unreasonable to allow more). In this case the gross power would be 331 horse power, and the disponible power by M. de Pambour's method, 262·315 horse power. The ratio of the latter to the gross power 331, or k, is thus equal to ·79249.

The gross power being assumed to be 331, instead of 305·81 horse power, makes P', the gross power required to propel the larger vessel of the same form as the Ruby at the rate of 16·55 miles an hour 892·46 horse power, which multiplied by k, gives 707·27 for the disponible power required to be applied to the paddle wheels.

The amount of power absorbed by friction and other losses in the engines is thus, on the principle of the Ruby's engines 185·19 h. p., on that of the Rochester's 397·03 h. p.

So that the London engineers are not only capable of constructing engines which would propel vessels at the rate of 16·55 miles an hour (which has only been claimed for the Americans in one solitary instance), but they can obtain that result with less than nine-elevenths of the power employed by their transatlantic brethren.

It is however to be observed that the quantity of water boiled off, and consequently the expenditure of fuel would be greater in the English engines of 892·46 horse power in the American engines of 1104·3, owing to the steam in the latter being expanded in the cylinder; but it is evident that, by adopting the principle of expansion in the English engines, the saving of fuel would be in proportion to the saving of steam, and might be carried even much farther than in the engine of the Rochester.

ABSORBENT ARTESIAN WELLS.

By Hyde Clarke, Esq., C.E., F.L.S.

The plan of artesian wells for the supply of water, we have mainly derived from our neighbours the French, and it is one which has been frequently canvassed in your Journal. I have now to call the attention of your readers to another application of boring, which in the present advanced state of geological knowledge and mechanical science may perhaps be productive of some advantage here. It is that of absorbent artesian wells, or cesspools, a system successful on a small scale, but which I am not aware has been carried to the same extent as in France.

The following account of absorbent artesian wells at Paris is principally derived from the report hereafter referred to made to the Prefect of Police by M. Parent Duchatelet, the well known writer on hygienic police. The reasoning will apply equally to London, as the London basin is much the same as that of Paris, with the omission of the tertiary building stones.

The city of Paris, for the purpose of suppressing the Laystall at Montfaucon, has within the last few years established a new one in the forest of Bandy. Although, this latter in 1833, received only a quarter of the soil daily supplied by the city, it occasioned, even at that period, great inconvenience both with regard to conveyance and dessiccation, on account of the existence of a stratum of water, the height of which, varying according to the season, often reached the level of its basin. A part of the fluid in excess might, it is true, have been turned into the little brooks, which spring up at a short distance, but as these brooks all run into larger streams and cross several villages and private properties, and indeed the town of St. Denis, would have caused just complaint on the part of a manufacturing population of ten or twelve thousand souls, for which the water is required to be extremely pure.

It was in order to surmount these difficulties that the contractors for the Bondy Laystall, stimulated by examples to which we shall hereafter have occasion to refer, thought of turning into the earth, at a considerable depth, the superfluities of their reservoirs. M. Mulot, C.E., was in consequence charged with the boring of an artesian well, intended, not for the purpose of bringing water to the surface of the earth, but to absorb that which should be sent down its shaft. This attempt was crowned with complete success; the boring having been carried to a total depth of 243 feet 7 inches, (74 m 71) showed two absorbing strata, one from 133 feet 5 inches to 155 feet 4 inches in a mixture of chalk and silex, and the other from 211 feet 11 inches to 243 feet, in argillaceous sand, and green and grey sands containing lignites and pulverised shells. By the first, 60 or 70 cubic yards were absorbed in four and twenty hours, and by the second 140 cubic yards in the same time.

The Prefect of Police, alarmed at the consequences which might arise, affecting the salubrity of the waters under the surface, from such a large mass of dirty fluids being mixed with them, ordered the process to be suspended until a committee of the Board of Health had examined into its operation.

In the Paris basin are several distinct strata of water, separated from each other by impermeable layers of different kinds. The first, that is to say the most superficial of these strata, is not to be found under the city of Paris; it is only met with on the tops of the hills and plateaux which surround it on all sides; it is retained by a thick bank of clay which is found above the masses worked as plaster quarries. For this reason, on these plateaux, 600 feet above the level of the Seine, the wells are often only two or three yards deep. This stratum is evidently formed by the filtration of rain, and by the condensation of vapour on the surface of the soil of the plateaux.

The second stratum, which probably depends on the same causes, but which extending under Paris and throughout the valley of the Seine near it, collects its waters from a much larger surface of country, and flows across sands which are between the plastic clay, and the building chalk (*calcaire à batir*, wanting in the London basin). It supplies all the wells in Paris, to the number of twenty-five or thirty thousand.

The strata of water below the two first can only be reached by boring; their number and the depth at which they are to be found vary to a great degree; sometimes they are entirely wanting, they do not always ascend, and if they reach the surface through the well, their overflow is not the same in places nearly contiguous. It is very important to be observed that these strata are so much the more abundant, as they are found at a greater depth, and that they have a rapid current, which gives them the character of subterranean rivers.

Numerous facts on the contrary prove evidently that the two first strata have no current, and are completely stagnant. The first, that which is above Paris, is very scanty, and there is a risk of infecting it by sending into it a large quantity of dirty water. To be convinced of this, it is enough to observe that the waters which came from the side of Mount Valerien are excellent, and those from Montmartre are not drinkable on account of the number of cowhouses and dung-pits which lose there all their liquid portions. The second stratum, that which supplies the wells of Paris, was formerly of good quality, and was used for drinking by the inhabitants of the houses, and neighbouring villages. It has only been since the increase of cesspools, and especially since the introduction of privies into houses, that is to say from the time of Francis the First, that the water has begun to deteriorate, and that the Seine water has been obliged to be used for drink. It must not, however, be thought that the influence of dirty and infecting waters extends beyond a very narrow boundary. Thus it has been found that around the great laystalls which were formed by the city of Paris near the barriers of Montreuil and Fourneaux, the well-water was never affected beyond a radius of 150 or 200 yards. The village of La Chapelle near Paris, not being able on account of its situation on depressed ground, to get rid of its dirty water, was obliged in order to disperse it to dig immense cesspools which swallow up all that is thrown into them. Besides a population of four thousand souls, the village of La Chapelle contains an enormous quantity of horses, cows, pigs, &c., and yet the wells near the cesspools have never been infected beyond two hundred yards from them. A still more decisive fact than the preceding is afforded by the history of the laystall of Montfaucon. Towards the close of the last century, before the conduit was made which discharges into the Seine, the surplus of the basins, one of the contractors for this laystall thought of digging in the lowest part a series of wells of large diameter, of which the bottom touched the stratum supplying the neighbouring wells. He succeeded by this means in getting rid of the troublesome water, and the wells around were infected, but not beyond a radius of 200 yards. A very long period is required to enable the gradual removal of water, by means of the alimentary stratum, to cleanse an infected well, of its bad qualities. A manufacturer in the Faubourgh St. Marceau wishing to get rid of the hot water of his steam engine at small expense, thought of sending it into a different well from that which fed his boiler. For some months this produced no inconvenience; but gradually the water in the neighbouring wells got warmed, and at last to such a degree that it could not be used for many purposes. The warm water was obliged to be sent in another direction; but it took *eighteen months* to bring the wells to their primitive temperature. We must add however, with regard to the gradual renewal of the water in the wells of Paris on account of the ever increasing consumption necessary for industrial purposes, that the suppression of the cesspools which the police no longer allow in the houses, and especially the establishment of moveable water closets, or at least with staunch walls, will prove so many causes which will probably in a few years carry off the bad qualities of the well water.

As to the lower strata, their abundance, and the rapidity of the currents which prevail in them, prevent us from assimilating them to wells, or from regarding the deperdition of dirty water, even in any very great quantity, as exercising a pernicious influence. In 1789, the architect Viel being employed by the Hospital Board to free Bicêtre from the rain and household water, as well as from the urine and fecal matters produced by a population of more than four thousand souls, he thought of directing the flow towards some old quarries deep enough to reach the stratum supplying the neighbouring wells. But wishing to have a permanent infiltration, he sought the second stratum by means of a well 15 yards deep from the bottom of the quarry, this well is ten yards broad at top, and ends in a bore of large dimensions, thus forming a cistern with which the several galleries of the quarry communicate. It was in the month of November, 1790, that all the water of Bicêtre was introduced into this cesspool, and from that day it has always run off easily. It is true that the wells situated on the right bank of the small river Bièvre, 150 or 200 yards from this cesspool, have been infected; but that arises from a circumstance purely local, rain water after storms, accumulating in the galleries, which communicate with the cesspool, and exercising an enormous pressure, cause the infiltrations to rise to the first stratum. For the purpose of remedying this serious inconvenience, the Hospital Board ordered a new absorbing well to be bored in a better position, which, since the year 1835, has absorbed 100 cubic yards of liquid, in twenty-four hours. Besides, the infection produced by the other did not extend to a great distance, for all the wells on the left bank of the Bievre, and the well of Bicetre itself, which is used for drinking by the population of the establishment, have never ceased to supply good water.

Notwithstanding the remarkable success attained at Bicetre ever since 1789, a considerable time elapsed before the boring of artesian wells was employed elsewhere for the dispersion of water, which have no drainage on the surface. A few years ago an artesian well having been bored on the Post Horse Square, at St. Denis, it was found that the waters, deprived of easy drainage, caused during frosts great impediment to traffic from the ice produced. This inconvenience had almost caused the plan for a new spring on the Place of Guelders to be abandoned, when M. Mulot engaged with the corporation to *disperse into the interior of the earth, when wanted, the waters brought to the surface after they had been used for such purposes as were required.* The new well was carried to the depth of 70 yards, and in the interior were arranged three concentric tubes like those of a telescope, with this difference that instead of there being any friction, they were separated from each other by a space four inches broad. The water supplied by the deepest stratum is brought to the surface through the interior of the smallest tube; the water of a stratum 60 yards deep is collected in the same way through the space between the smallest and the middling pipe; and the third tube, enclosing all the others, collects and disperses into the third (non-ascending) stratum the excess of water supplied by the two others.

A manufacturer of potatoe starch at Villetaneuse, a small village three miles from St. Denis, by means of an absorbing well, gets rid of the infected water, which had caused such serious complaints as would, very probably, have obliged him to have closed his establishment. The bore was carried to a depth of 70 yards, and during the winter of 1832 and 1833, the well carried off 80 or 90 cubic yards of liquid per day. After it had been in operation for five months, the borer carrying a scoop, with a valve at the end, was sent down, but, to the great surprise of the manufacturer and engineer, only brought up sand and whitish water. This fact, which shows so strikingly the rapidity of the lower currents, is enough completely to remove any fear which might be entertained of the inconvenience of dispersing among these currents such a quantity of infected water.

Relying upon the previous examples the Board of Health recommended the administration to leave the contractors of the Bondy laystall at perfect liberty, and accordingly every twenty-four hours a hundred cubic yards of liquid, charged with a considerable quantity of solid matter are dispersed into the absorbing wells.

An absorbing well constructed by M. Mulot for the city of Paris in 1835 at the Barriere de Combat, and also described in *Magasin Pittorsque* carries off a hundred cubic yards per hour. The contract price was £336 (8,400 fracns.)

M. Arago attributes the invention of absorbing wells, as well as of the ascending ones to the French. René, the famous King of Sicily and Count of Provence, had a number of cesspools dug near Marseilles, in the Plain of Paluns, a large marshy basin, which it seems impossible to drain by superficial canals. These holes throw and continue to throw into the permeable strata, lying at a certain depth, the waters which would render the country unproductive. It is said that the water absorbed by the cesspools of Paluns, after a subterranean course form the gushing springs of the Port of Mion, near Cassis. This is the most ancient example of the kind. These cesspools are called in Provensal, *embugs*.

The most important results are naturally expected from works of this nature, which it is anticipated will place new resources within the reach of the engineer. They will afford the means of draining marshes, which otherwise could only be cleared by difficult or expensive processes. The application to sewage is too evident to need inculcation, they will enable us to relieve many small streams, which receive the sewage of large and dense populations, and in every way they give to the engineer abundant promise of being able to contribute in various ways to the improvement of the public health. The extension of the system at Paris is proceeding rapidly, and it is to be hoped that it will be equally introduced in this metropolis, which lies in a similar geological position. The marshy districts of Hackney, Lambeth and Woolwich might be relieved, and instead of Mr. Martin's expensive plan for the improvement of the sewage, the Thames might be much more easily relieved by the filth being turned into absorbent wells. It may be believed that the dirty water becomes disinfected much more certainly, and so returned much sooner into circulation, by being dispersed in the under currents, than in the superficial waters.

CANDIDUS'S NOTE-BOOK.

FASCICULUS XIV.

> "I must have liberty
> Withal, as large a charter as the winds,
> To blow on whom I please."

I. It is said that Albert—or as some pretend he ought to be styled, 'His Majesty!' has a great deal of taste for all the fine arts;—and so, indeed, had George the Fourth, the misfortune was that it was—in architecture, at least, intolerably bad, as Buckingham Palace most plainly testifies. But let us hope better things of Albert,—that he will merit the epithet of *Kunstliebend*, and that he will exercise his influence in behalf of that art which most requires it—to wit, architecture. I trust he will have taste and to spare—for there will be many about him not overstocked with it; yet how people instantly discovered that he has such abundance of it, before he has done any thing to show it, is rather puzzling; except that they have taken it for granted, upon the principle that

> "All soldiers valour, all divines have grace,
> And maids of honour beauty—by their place."

and of course a Prince Consort must be a phœnix of taste and accomplishments,—a second admirable Crichton.

It will be well should his architectural taste induce him to keep his eye upon the new stables at Windsor, and to hint—in whatever quarter it may be necessary, that they ought to be something less disgraceful in design than the Mews behind Buckingham Palace. To say the truth, royalty appears to have been hitherto singularly unlucky in its choice of architects, in this country; which is all the more provoking because it is not Royalty but John Bull who has had to pay for the blunders and execrable designs of such persons as John Nash and Co.

II. However great architects may be in their own estimation, it would seem that they are little better than mere cyphers in that of the world,—such perfect nonentities that their names are of no importance. I lately met with a very florid description of the Prince of Orange's Palace at Brussels, according to which that building is one of extraordinary splendour and taste, yet who the architect was is not mentioned. Neither is such omission by any means uncommon; on the contrary, it seems to be *selon les regles*, and the giving an architect's name to be the exception to the rule. Dr. Granville for instance, not only speaks of the palace of the New University at Ghent, "which for chaste design combined with a rich and imposing style, yields the palm to few modern buildings, and is superior to any erected for the same purpose," but actually gives an elevation of its octastyle Corinthian portico; and yet does not consider it worth while to inform us who was the architect. Hundreds of other instances of the kind might be produced, even from works professedly on the subject of architecture. It may therefore be presumed that, unlike those of any other, the members of this profession are distinguished by a strange excess of modesty;—or if not, they must be grievously disappointed at finding that nobody cares to know even of their existence.

III. Architectural descriptions—or what profess to be such, are sometimes exceeding funny. In those accompanying Pugin's Views of Paris, and *done* by a French teacher named Ventouillac, we read of the front of a building being "adorned by two *perpendicular* ranges of columns," in addition to which curious information, we are assured that it resembles "Palladio's celebrated portico of the cathedral of Vicenza," the Basilica or Palazzo della Ragione of that city being blunderingly converted into a church. Poor Pugin was grievously annoyed at those and other instances of stupidity,—and no wonder; but the publisher was well satisfied that the work was done cheap, and nothing extra charged for such drolleries. It is not always, however, that they manage matters much better elsewhere, for turning over an Italian journal to-day, I met with some account of a book entitled "Quadro Storico dell' Architettura, dal Marchese Malespina di Sannazaro," where it is stated that St. Peter's was *begun* by Michael Angelo, and completed by his pupils and successors, among whom the principal one was Bramante!!—What a truly ingenious and delightful way of writing—or rather mystifying history! I know nothing to be compared to it except the following wicked bit of quiz: "Hannah More, the daughter the late of Sir Thomas More, who was beheaded in Utopia, was the author of Little's Amatory or Inflamatory Poems, to the infinite scandal of her worthy brother the present Sir Thomas, well-known in the religious world by his work entitled Practical Piety, and by another entitled "Cælebs in search of a Saint in petticoats,"—or this other, "The *Lousiad* of Camoens was written by Pindar the celebrated Greek poet, who lived in the reign of George III."

IV. There is a Finnish proverb which says, "Charming girls, lovely maidens!—where then do all the cross ugly wives come from?"—and which is not wholly inapplicable to architecture, since it is no less unaccountable where all the ugly, tasteless, paltry buildings and designs we behold, come from, when we read of the host of talent there has been and continues to be in the profession;—of the taste of such a man as James Wyatt, of the classical genius of Sir —— ——, of the imagination of John Nash;—or of the transcendent charms of any of those orthodox styles, which in our extreme affection for them we not only adopt, but generally take care to make our own by the patriotic process of Cockneyizing them into the bargain.

V. It is odd that though there are Doctors of Music, there should be no Doctors of Architecture. Perhaps it is because architecture is supposed to be in so sound and healthy a state as to require no doctoring. And yet, neither Mr. Joseph Gwilt, nor Mr. Welby Pugin seems to be of such opinion: on the contrary, both of them are for administering to it pretty strong cathartics. Surely they are entitled to add A. D., (*i. e.* not Anno Domini, but Architecturæ Doctor) to their names. There is also a certain scapegrace Candidus, who some will say, might be similarly distinguished, yet others may think he has far more of the Surgeon than the Doctor in his composition.—After all, perhaps it will be said that if Architecture has no Doctors, it has a tolerable number of Quacks.

VI. Vorherr, a living German architect, has a singular crotchet in regard to what he names *Sonnenbau*, which is that all sitting and sleeping rooms should invariably be made to face due South, having only staircases, passages, store-rooms and such places behind them. The reasons he adduces for it are satisfactory enough, and the chief objection to his scheme is that it is utterly impracticable, at least in towns: for supposing all the streets were made to run from East to West, and to be of such width that the shadow from the houses on the South side would never fall upon the opposite ones, it would be only these latter that would have their fronts, or at least their dwelling rooms facing the street, for the rest would have such rooms looking towards the garden or courts behind them—that is behind, as regards the street. This however I myself should consider no objection—rather a recommendation, because I could never understand what pleasure there is in standing at a window to stare or be stared at by your opposite neighbour. Indeed I should say that those houses would have the advantage whose sitting rooms were turned from the street, because they would not be exposed to the noise from carriages, &c. But then, unless the backs of those houses were made to correspond with the fronts of the opposite ones, the streets themselves would make a very strange appearance, presenting a row of fronts on one side, and irregular exteriors on the other. Besides which, much greater extent of frontage towards the street would be required for each house, as the houses must be long and shallow, in plan, instead of being as at present, narrow and deep. There is yet another difficulty standing in the way of such scheme, which is that were all the streets of a town made to run from East to West, there must be lines of communication between them from North to South, which according to such plan would be entirely between dead walls—that is, the ends of the houses in the streets, and the walls enclosing the gardens and courts, or whatever the intermediate space might be between the parallel rows of houses. I may therefore venture to say that *Sonnenbau* will, notwithstanding all its advantages, never come into fashion in London, even if it should anywhere else.

THE PATENT CONCRETE.

Sir—I have read an article in your Journal for the month of January last, describing the works in progress in her Majesty's Dock-yard at Woolwich, wherein it is said that the "*Patent Concrete of Mr. Ranger was found insufficient to keep down the Land Springs.*"

Although the assertion may be correct as far as relates to the work in question, viz., the dock which was constructed of that material, at Woolwich; yet, as such an assertion appears to question the efficiency of the patent concrete, I beg to state to you my decided opinion that the failure arose from a deficiency in quantity, and not from any defect in quality; from an improper manner of applying it—in fact, from a misdirected economy—the excavation being only lined as it were with concrete to form the bottom and the altars, instead of the earth being taken out of such dimensions as to admit of the concrete forming a solid spandril under the altars, (the back line of which should be perpendicular from the outside edge of the dock coping), and of having at least 7 feet in depth under the bottom of the dock. This will be better understood by the following figures.

These are not given as *correct* sections of the dock in question, but as diagrams sufficiently accurate to illustrate the accompanying observations.

Fig. 1.

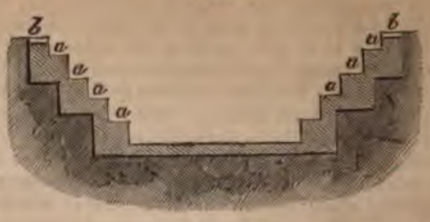


Fig. 2.

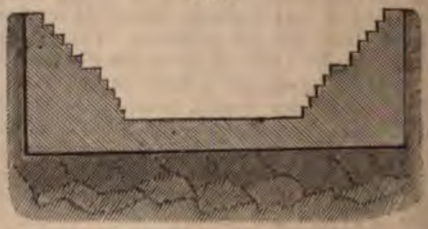


Figure 1 is a section of the dock as executed, where *a a*, &c. represent the altars, and *b b* the coping, the concrete at the bottom of the dock being about 2 feet 6 inches in thickness. By this figure it will be seen that unless the ground under the altars is of a very firm kind, such as good gravel, the weight of the concrete in the altars (being of equal specific gravity with Portland stone,) must cause a settlement, as they are in effect all overhanging, and the whole of the work, supposing each side to settle, (which may well be expected in such soil as that of Woolwich Dock-yard), would open somewhat similar to a book; and it is quite plain that any settlement of the altars would have an injurious effect upon the bottom, unless it was made of a depth much more considerable than it was in the present case, where the thickness was not more than one-third what it ought to have been.

Figure 2 shows the dock as I conceive it should have been constructed. Here it will be seen that the mass of concrete is about three times the sectional area of that in fig. 1, and I feel convinced that if this section had been adopted, no failure could possibly have taken place.

It may be here remarked, that in the construction of docks built of stone, the backing necessarily must form such a spandril as I have mentioned, and this is generally composed of bricks and cement; and why this solidity of form should have been departed from in the section of the dock in question, appears to be altogether inexplicable—and the more so when it is considered that Woolwich Yard is perhaps one of the very worst places in which so rash a step could have been hazarded.

With respect to land springs—I apprehend they may be expected generally to be troublesome in the progress of works in a Dock-yard, where the local pressure from high-water in tidal rivers, or from the sea, is calculated to increase the difficulty, so much so that the greatest ingenuity will sometimes be required to beat the enemy, even though granite and brickwork in cement be used.

I have lately seen a paper describing the method of treating springs as pursued by Mr. Ranger, at Chatham, where I find that gentleman ingeniously collected them by means of cast-iron chambers into pipes, and conveyed them into an adjacent culvert, by which they find their way into the Weir of the Dock-yard engine.

I have been led into these observations from an apprehension that the unqualified assertion, "the patent concrete was found insufficient to keep down the land springs," might be so conclusive to many persons who are not acquainted with its excellent qualities, as to prevent further inquiry upon the subject, and carry a conviction of its unfitness as a building material; while, on the other hand, I think that an examination of the subject will prove its peculiar applicability to the purposes of dock building, or any other massive work where the locality affords good gravel and lime.

At a future period I may return to this subject, and show the great economy of this material, as compared with granite and brickwork in cement; and I think it will not be difficult to show that two docks may be built of concrete, for one of granite and brickwork, and each of them equal in usefulness and stability, which must be considered a matter of no small moment in dock-yard economy at this period, when it appears so difficult to obtain from the rigid hands of our legislators, any adequate amount to be expended in those most important places.

I am, Sir, your obedient servant,

B. T.

Dublin, 14th March, 1840.

TOPHAM'S PATENT SLIDE-VALVE COCKS.

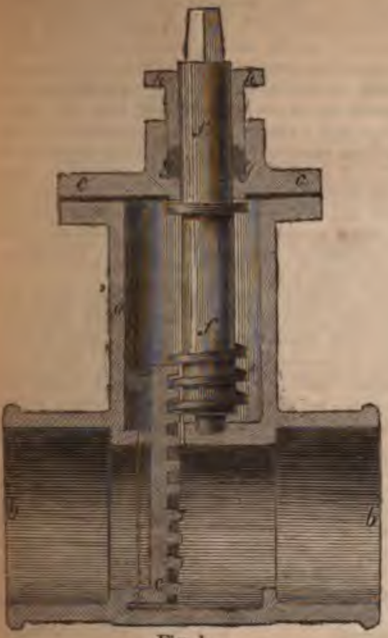


Fig. 1.

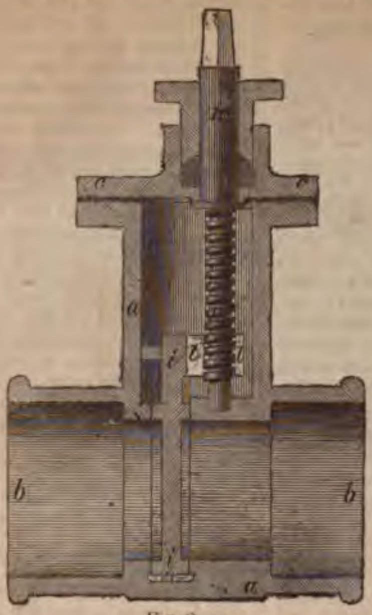


Fig. 2.

DESCRIPTION.

The outer case, in which the slide-valve is enclosed and worked, consists of a box, *a a*, with socket outlets, *b b*, cast in one, and a cap, *c c*, secured to the box by means of four wrought-iron bolts, the position shown at *d d d d*, in figures 1, 2, 3, and 4. Fig. 1 represents a vertical section of one form of the patent cocks, and fig. 2 is a plan of it with the cap off; *e e* is the slide with a rack cast upon the back of it; *f f* is a cast-iron spindle, with a screw cast upon it; *g g* is the stuffing-box; *h h* is the gland. This cock is intended only for what are termed *single*-faced cocks.

Fig. 3 is a vertical section of another form of the patent cocks, and fig. 4 is a plan of it with the cap off; *i i* is the slide with the double face, and with lugs, *k k*, cast upon it, to receive a female brass screw-nut, *l l*, and a wrought-iron square-threaded screw spindle, *m m*, as in the common double-faced screw cocks.

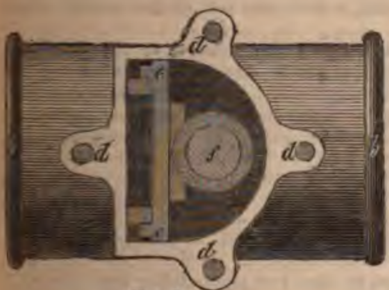


Fig. 3.

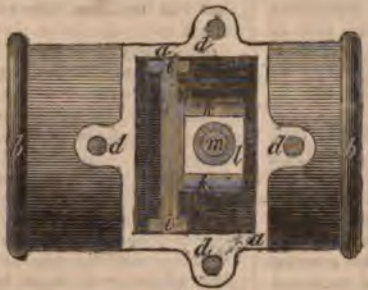


Fig. 4.

Observations.—In the screw cocks commonly used, the box is cast in two pieces, and the outlets are generally made with flanges, to which a socket and spigot piece with corresponding flanges are bolted. It is a well known fact that cast iron is not so liable to corrode as wrought iron, and therefore that dispensing with numerous bolts and three lead joints, will not only render the casing more durable, but enable it to be made at less cost. The side joints in the box or casing sometimes yield unequally; this prevents the slide shutting close to the face, thereby allowing the cock to "let by:" this is prevented by dispensing with the joint. Some cocks of the *smaller* sizes have heretofore been cast with spigot and socket instead of flange outlets; in the patent cocks, sockets are cast on both ends of *all* sizes; although it might originally have been supposed that by removing the cock, and leaving the flange, spigot and socket attached to the main or service, a new cock might have been introduced without breaking the main or service; *in practice*, when a new cock has to be introduced, the main or service *is* broken, and the junction formed by a double socket: it is therefore evident that the separate spigot and socket castings with flange joints are unnecessary. In the single-faced cock, the reason for introducing a cast iron screw and rack instead of a wrought iron screw, is that cast iron is less liable to corrosion than wrought iron, and therefore more durable.

The advantages of the patent cock are its simplicity and greater durability, (owing to there being fewer joints,) and cheapness. The facings of the cocks hereinbefore described are iron; if, from the nature of the water, cast iron is liable to corrode rapidly, the socket or sockets for single or double-faced cocks are made to screw in, and can therefore be faced with brass. The water supplied by the Water Works Companies in London, is of such a quality that *corrosion* of cast iron is very slow, and the extra expense of brass faces, or gun-metal screws, would be greater, when the interest of the money expended is taken into account, than the renewal of the cocks when rendered useless by corrosion.

Mr. Wicksteed, the engineer, has introduced these patent cocks into the services of the East London Water Works, and in a certificate dated Nov. 23, 1838, he states, that

> "The chief difference between your patent cocks and those commonly used, consists in the body of the cock being cast in one, and the outlets in cocks of *all* sizes being cast on the body, instead of having flange, spigot and socket pipes attached thereto. By this means you undoubtedly not only dispense with the greatest portion of the lead-joints and screw bolts ordinarily required, and in consequence reduce the cost also, but the slide will be less liable to get out of its true working position, which it is apt to do from unequal yielding of the side-joints; and thus the necessity and expense of repairs, which have been rendered hitherto necessary, will be dispensed with. Although the application of the cast iron worm and rack may not be new, it is certainly not in general use: and, in single-faced cocks, may be used to great advantage. It will, in my opinion, be more durable, and is more simple, and less expensive, than the *wrought* iron screw spindle and *brass* screw nut.
>
> "My experience inclines me to consider the use of brass facing in cocks, where Thames or River Lee water is used, unnecessary, as I know several cast iron sluice gates, with iron facings, that have been worked, and exposed to the action of these waters, for a period of nearly thirty years, that are now in as good a state as possible; the faces are not at all corroded, and the gates are water-tight. I therefore consider the use of brass, in such instances, as unnecessary and expensive. Nevertheless, should the water contain salts that would affect cast iron so as to injure the faces, the mode you propose in your specification, for facing with brass, appears to me well calculated for the purpose, without affecting the principle of dispensing with the side and other joints and bolts."

Mr. Wicksteed has furnished Mr. Topham with another testimonial of recent date, March 16, wherein he states, that

> "After having used your patent cocks constantly for two years, I feel enabled to speak as highly of them as I did in my letter to you dated Nov. 23, 1838, and would strongly recommend their general adoption."

AMERICA.

INTERNAL IMPROVEMENTS AND PROSPECTS OF THE PROFESSION.

[The following article has been forwarded to us by our highly valued correspondent at New York, it was written for the American Railroad Journal, and is well deserving the perusal of the Engineers and *Government* of this country, many of the remarks are equally as applicable to the latter as they are to the American Government.]

THE attempt to form an Institution of Civil Engineers, has, we are sorry to say, failed. We are not, however, without hopes that another effort, more successful, will soon be made. We have heard a variety of opinions on this important project, and, earnestly as we desire its success, we must admit that there are difficulties in the way, which it is much easier to point out than to overcome. In the first place, it seems impossible to fix on any place where the leading members of the profession could meet even once a year, far less every week, as in London. The public works of the United States are scattered over such an immense extent of country, that there is probably no point where even half a dozen engineers, in charge of as many works, could meet even monthly. If we are right in this view, it is evident that the plan which succeeds so well in England, or rather in London, is not adapted without modification to this country. Then, again, the distinction between Members and Associates would lead to endless contention, though all will admit that some such division is both necessary and proper; but where to draw the line is the grand question. They who have held the rod, have carried the compass and level, have surveyed hundreds of miles for railroads and canals, and superintended the construction of not a few, are not pleased with the idea of being ranked with those who, having failed as lawyers, doctors, store-keepers, or office-hunters, "turn their attention," as the phrase is, to civil engineering, and who, in only too many instances, have at once received appointments to which they should have looked after five or six years arduous service in the field in the various grades of the profession. More than one of our readers could, without much difficulty, point out men in the situation of Residents, or even higher, who would be puzzled, if directed to take the goniometer into their own hands, and run out a curve of a given radius, to join two tangents given in position, while the same feat constitutes one of the very easiest duties of their assistants—the unpresuming title of those who do almost everything. There is a very large class of assistants in the United States who, from want of education, or subsequent aversion to study, or both, are unable to reach the highest stations of the profession, to which their long experience and practical skill fully entitle them. It is only when acting under men who combine liberal and scientific attainments with the proper experience, that this large class of eminently useful engineers can ever attain their deserts, and it does appear reasonable to suppose, that they would derive great advantages from a well-constituted institution, where their industry, skill, and perseverance would be honourably registered by those who are alone capable of appreciating them. On the other hand, young men of superior talent or acquirements, have only to offer original communications to the Institution to be immediately known, and to be at once installed into the very position to which they are by their merits entitled, being neither ruined by injudicious flattery nor chilled by neglect. How different are the means by which a young engineer now seeks to rise in his profession, on the Government works, in which are included nearly all the works of this country. His political creed, and the number of votes he and his friends can command, would far outweigh the professional claims of a rival who might unite in himself the genius of all the engineers of the age; and this is the grand obstacle to the advancement of the profession in the United States.

We will briefly allude to the manner in which many works are "got up," more especially in the Western States. A "celebrated engineer" is employed to survey a railroad from 100 to 500 miles long; he makes a "highly favorable report" to the Legislature, on the strength of which they "authorise a loan," and "locate the line," though it is known to every well-informed man in the State, that the work cannot be put into operation for less than three or four times the original estimate, and when it is capable of demonstration, that the country cannot possibly furnish business enough to keep the work in repair and pay interest on the loans, far less pay anything towards diminishing the debt, until the population has increased at least ten fold—say in from 50 to 100 years. Now it is obvious, that such men as Walker, Brunel, Stephenson, and a host of others in England, and we are proud to say, not a few in this country, whom we do not feel ourselves at liberty to name, are found utterly impracticable in such cases, and they are consequently avoided with as much care by the projectors of works to be built on the credit of the government, as they are zealously sought for by those who project works to be executed by the expenditure of their own actual capital. The evil of employing men incompetent from want of education, practice and character eventually recoils on the State; hence the financial difficulties of all the States who have largely embarked in the construction of public works.

The State of New York furnishes some very instructive examples. By dint of much management a law was passed some years since, that, if a certain canal could be made for a million of dollars, it should be forthwith undertaken by the State. An engineer was immediately employed to survey the route, and he reported, that the work could be constructed for nine hundred and ninety odd thousand dollars, though this was only at the rate of one half the actual cost of a similar canal, presenting fewer engineering difficulties, which had just been completed. The insufficiency of the estimate must have been as well known then as now, still, the law had passed, and the engineer had reported "favorably," so the million was spent, and a million and a half more was then required to complete the canal in the cheapest manner. Three years after handing in an estimate for the enlargement of the Erie canal, the following reasons are given for requiring 100 per cent. additional. "A uniform plan" was not "adopted in the estimates," "and not much reflection had probably been bestowed on the particular manner in which the work should be done." It is also very properly observed, that frost is a very destructive agent in Northern climates, that a large canal requires stronger banks than a small one, and that work done in the winter costs more than in summer—all which would have readily suggested itself to individuals about spending their *own* money, even had it escaped the penetration of *their* engineers for two or three years.

Again, the Croton Water-works, nominally city works, though such no further than that the city pays for them, will contribute their mite towards developing the wonderful facility with which government engineers adapt professional opinions to the wishes of government commissioners. We must premise that the water commissioners had, till last year, delayed fixing on the plan for crossing the Harlem river, the most difficult and important work on the whole line. The plan then brought forward was opposed by certain proprietors of lands on the river, and the legislature decided unanimously against the commissioners, though the party to whom they owed their existence had a large majority in one branch—a case nearly unparalleled in New York legislation. The use of iron pipes for crossing, by means of an inverted syphon, the commissioners' plan, was unnecessary, with the high bridge prescribed by the Legislature, but, as the former are as averse to being interfered with as they are prone to interfere with others, they have announced their intention of complying with the law no further than absolutely necessary, that is, they will keep the aqueduct 12 ft. below grade and use the pipes. We quote their own words:

> "The bill as revised, * * * is in substance as follows:—the aqueduct to be constructed over the Harlem river, with arches and piers, the arches in the channel of said river to be at least 80 feet span, and *not less* than 100 feet from high water mark to the under side of the arches at the crown.
>
> "The original design of a high bridge, as designated in our report of January, 1838, required arches of 112 feet in the clear above high water mark, which is 12 feet more than that required by the Act of May, 1839. A bridge, therefore, of 100 feet height of arches above tide, will have to be passed by iron pipes or syphons, to accommodate the ascent and descent of the 12 feet from grade. This bridge will be more economical in its construction, and not subject to so many contingencies, from its less elevation, as the plan originally proposed. The parapets will only be 114 feet in height, which is 17 feet lower than the plan of 1838; and as the arches are thus reduced in height, stone of a diminished thickness may be used. It is proposed to carry the water over the river, at the commencement of supply, by two three-feet pipes, adopting the work, however, to carry two pipes of four feet diameter, when the city shall require it. *The same arrangement for pipe chambers, and waste cocks, will be required in this structure, as was required for the syphon bridge formerly proposed.*

The engineer echoes, "In relation to the bridge, the law prescribes that the arches in the channel *shall be* 100 feet at the under side of the crown, above common high water mark of the river, and *not less* than 80 feet span, conforming in these respects, we are at liberty to make the plans in all others, without restriction from the law.

The arches of the bridge originally designed to maintain the grade of the aqueduct, were elevated 112 feet above the high water mark of the river, which is 12 feet higher than the *Act requires*. It is obvious, therefore, that 100 feet will not be sufficient to maintain an aqueduct of masonry, but *will require* iron pipes as conduits for the water. This I do not consider an objection, as I am fully satisfied iron pipes will make the most suitable conduit for the water on such a bridge, and therefore have had a plan prepared, with a view to comply with the law, and avail of the economy and greater permanence from a less elevated structure. The less height required for the arches, and by adopting iron pipes for the conduit, the top of the parapets will be 114 feet above high water mark, which is 17 feet lower than the original plan. The superstructure being lighter than necessary for an aqueduct of masonry, a *diminished thickness* of arch stone may with equal safety be adopted."

We should be pleased to know what diminution in the depth of the arch-stones this change of plan would justify, as well as the saving in cost, which latter, we strongly suspect, it would be difficult to express in the constitutional currency of the United States, without an extension of decimals several places to the right of "mills."

The following extracts, though trifling in themselves, go far to show the estimation in which the profession is held by government commissioners.

> "Notwithstanding the oversight of the inspectors and engineers, the work will, in a few cases, be carelessly performed; and it is only by the correcting influence of these repeated tours of inspection, made by the commissioners and principal engineers, that we can be certain the work is performed in a manner which will ensure its stability and imperviousness."

If the citizens of New York have no better guarantee than this, that the work has been faithfully superintended, that 4th of July on which the Croton water will be "regaling the taste and sight of our citizens," will be simultaneous with the millennium,

At p. 255, April number 1839, Railroad Journal, will be found the following cool assertion :

"The locks on the Chenango canal, which are 114 in number, are (with the exception of five stone locks) all of them composite. They were built under the direction of Mr. Bouck, one of the present canal commissioners, and their average cost was 3,808·50 dollars each."

We shall next be informed that the piers of the Potomac aqueduct have been successfully carried up under the direction of Mr. Forsyth, and that the Thames Tunnel has at length been completed under the superintendence of his prototype Lord Melbourne.

We refer to these circumstances only as effects of the policy of allowing the government to enter into the pursuits of individuals, and not with the design of insinuating that the mortifying reports of many government engineers are the *cause* of the present state of the profession, but simply to show that they are the legitimate consequences of the pernicious interference of the State Governments with that in which they have no more right to engage, than they have to establish theatres or hotels and then forbid any citizen from competing with them, on the miserable plea, that all the people of the State are interested in their tavern-keeping monopoly, that it bears equally on all, and is, to use the logic of governments, *therefore* just. The pecuniary difficulties in which most of the States who have engaged in railroad and canal speculations find themselves involved, will necessarily break down the entire system of State works, and their complete abandonment will, more than every thing else, conduce to the welfare, honour, and usefulness of the profession.

The success which has attended the expensive and well constructed railroads about Boston, is the most encouraging fact we have to record, and it is worthy of remark, that the stocks of those roads were the only stocks not affected by the bursting of the biennial bubble grandiloquently called the "late crisis." The Eastern railroad has been opened to Salem, and the number of passengers is already twice that estimated before the opening of the road, and on which the project was based. The Western railroad has been opened as far as Springfield. The Old Colony railroad is going on rapidly; the Norwich and Worcester is to be opened about new year's day, and the Housatonic railroad some time this month. In this State, the Utica and Syracuse railroad has been opened, and the Syracuse and Auburn railroad put into full operation. In Pennsylvania, the Reading railroad has just been completed, and in Maryland, we believe the Baltimore and Susquehannah railroad has been opened to the public. Two of the above roads have received aid from the State of Massachusetts, but they have all been managed, and, with these comparatively trifling exceptions, have been paid for, by individuals. *We do not know of a single State work having been completed, or in part opened, during the year* 1839.

In New England they have retained too much of the sturdy independence and common sense of their forefathers, to tolerate the meddling of the government in the affairs of individuals, and we seek in vain for a canal, a railway, a machine shop, a lumber or coal yard, owned by a New England State. It has been found impossible to persuade them that they are not as capable as their Transatlantic brethren of managing their own affairs, and the consequence is, that they have the best managed, best constructed, most costly and most successful, railways of any State in the Union. An attempt has been made to regulate the sale of spirits, and has proved about as successful as a previous effort to interfere with another article in the "grocery line"—y'clept "tea."

Some little has been done on the State works of New York, by means of the unexpended balances of former appropriations for the enlargement of the Erie canal, and the construction of the Genessee valley and Black River canals. There is no little curiosity to know how the first is to be disposed of—not only both parties, but every sane resident of the State, who feels an interest in her honour and welfare, being heartily ashamed of his credulity in believing it either practicable with the means of the State, or useful even if practicable. The money already thrown away on this unrivalled specimen of legislative folly, will do something towards opening the eyes of the citizens of this State, and a year or two hence we fully expect to find the enlargement as unpleasant a reminiscence in New York as the suspension is in a neighbouring State.

The lateral canals of the State of New York cannot with propriety be passed by, being "par excellence" government works in their conception, management, and income. As the official report on the Genessee valley canal has been published, we will examine the proceedings of the Commissioners with regard to that work, and our readers, by turning over their files, will be enabled to judge of the accuracy of our deductions. The original estimate of the canal was a little less than two millions, but the present estimate is thus stated in the report alluded to.

"The cost of the canal (excluding 314,520·43 dollars for the Dansville branch,) is estimated by the Canal Commissioners in their recent report, (Assembly Document of 1839, No. 360,) at 4,585,602·36 dollars.

"The canal board are not possessed of all the facts necessary to enable them to estimate with sufficient certainty the future revenues of the canal. They fully appreciate its value to the interesting section of the State whose resources will be developed by its completion. In respect, however, to the tolls to be derived from it in the present state of the navigation of the Alleghany river, the board would observe, that in the year 1835, F. C. Mills, Esq., the engineer who surveyed the route, submitted an estimate to the Canal Commissioners of its probable revenues, (Assem. Doc. of 1835, No. 264, page 42,) in which he computed the tolls, independent of its probable contributions to the Erie canal, at 39,129·60 dollars. Of this amount, 13,207 was estimated for the tolls on the finer qualities of lumber and other products of the forest, which, it was supposed, would seek the New York market in preference to that on the Ohio and Alleghany rivers. A majority of the Canal Commissioners, (including the late acting Commissioner on that canal,) in the report above referred to, have expressed their belief that the amount of 39,129·60 dollars, is "greater than will be realized for at least the first few years after the canal is completed."

Now let us translate this into plain unofficial English, such as is used in the every day transactions of common men, not devoid of common sense. It is proposed to construct a work at the expence of the State, the cost of which is estimated at two millions of dollars, and its *gross* income at less than 39,000, one third of it to be derived from lumber, which, it is well known, will soon be exhausted. The canal is to be 106 miles long, and we know from experience that 39,000 dollars will not meet the ordinary annual expenses, repairs and renewals. We will, however, suppose this sum sufficient for those purposes, then the people of this State are saddled with a "gentleman pensioner," who cannot exist on less than 100,000 dollars per annum. On comparing this, however, with the Chenango canal, it was discovered that the annual deficits of the latter exceeded those of the former by 20,000 dollars, and as the march of the Commissioners was "still onward," they at once decided on such an addition to the estimate as should place the Genessee valley canal as far "ahead" of the Chenango, as the latter was in advance of the other "auxiliary" canals. They determined accordingly on spending five millions on this work, which will entail on the State a permanent annual tax of 250,000 dollars at least.

Now, does any man, out of office, believe that the people of the State of New York would have authorised an expenditure of five millions of dollars on a canal which its friends and projectors assert will not yield more than 39,000 dollars gross revenue, merely for the privilege of having their money squandered by a set of Canal Commissioners? Before seriously entertaining such a project, far less recommending it, they ought to have been able clearly to establish the probability of an immediate income equal to

	Dollars.
Annual cost of repairs, renewals and expenses . .	50,000
Interest on five millions of dollars . . .	250,000
Towards paying off the debt, at least . . .	100,000
Making the total minimum income,	400,000

or ten times the estimated income, the latter being in fact, too insignificant in amount to have any material bearing in discussing the value of an undertaking which is to cost five millions.

Suppose that the State of New York, after expending one million on the Chenango canal, had refused to submit to any further imposition, that canal would be unfinished, its revenue nothing, in place of 20,000 dollars on an expenditure of two and a half millions, practically speaking, nothing; the State would have saved one and a half million, and would only have incurred a permanent annual tax of 50,000 dollars instead of 120,000 dollars, which the people of this State are now paying for the glory of owning the Chenango canal. We give an extract from an article which appeared in the Courier and Enquirer of 7th May last, in which the writer undertakes to prove that lateral canals generally will be nearly useless in themselves, and of little value to the main canal. Whatever may be thought of his *reasons*, it is only too true that his conclusions are fully borne out by the actual experience of this State.

"I have never seen any attempt to explain the causes which render the lateral canals unable to pay expenses, though it appears to me to be by no means difficult. The policy which led to the construction of these lateral or auxiliary canals, has no analogy with that which influenced and guided the projectors of the Erie and Champlain canals. The immediate object of the former, was to open to the husbandman the extensive and fertile region of western New York; that of the latter, to bring within reach of the city the forests of the North. Both have fully succeeded—not because there are no other such routes "in the world," but—because they were projected in such a manner as to open the greatest possible extent of country, and without reference to mere local interests. With the lateral canals the case is widely different, for it is evident, that the main canal will command the business of the country through which it passes, for a certain distance on each side, this in an agricultural country, will vary from 25 to 40 miles according to circumstances; but, whatever distance be allowed, it is clear, that the portion of the lateral canal contained within these limits, will only receive the contributions of those directly on its banks. If the lateral canals be from 80 to 100 miles apart, it will be found, by a few simple calculations of distances, that a very small portion of the country between the lateral canals, and within 40 miles of the main canal, will derive any advantage from the lateral canals. Hence the insignificant revenue of the Seneca, Crooked Lake, Chemung, and Chenango canals. The two first are in the country directly tributary to the Erie canal, one half of the Chenango canal is liable to the same objection, and the other half and the Chemung canal would suffer from the New York and Erie railroad, had they more than a nominal revenue. The Black River canal proper lies within the influence of the Erie canal, and its extension to the Lake or the St. Lawrence will only furnish a slower, more expensive, and more troublesome communication between its termini, than the present excellent one by Lake Ontario and the Oswego canal. Lastly, the Genessee Valley canal, with the Erie canal on the north, and the Erie railroad on the south, bids fair to be second only to the enlargement in disposing of the surplus revenue, or rather to the vast annual deficiencies, which nothing short of an entire change of policy can possibly avert. If the Black River and Genessee Valley canals, estimated at ten millions, be immediately abandoned, the State will lose about 500,000 dollars, which may be considered an anticipation of the payment of one year's deficiencies of these canals when completed, by the immediate forfeiture of which, the State will save a like expenditure per annum in perpetuity, besides the immediate disbursement of a sum nearly equal to the entire cost of the Erie and Champlain canals."

The estimates for these canals have since been reduced, and their probable deficiencies are estimated by Mr. Paige (Sen. Doc. 1839, No. 101, p. 7,) at 450,000 dollars, and if the sum now spent on these works does not exceed two millions, their immediate abandonment will save the State 350,000 dollars per annum—a sum more than sufficient to support the government. We shall have occasion again to refer to the above report, which contains the most sensible view of the public works owned by this state, which has fallen under our observation: and it derives great value from the circumstance that the writer is justly considered one of the ablest men of the party to which we are indebted for the lateral canals and the enlargement, and would naturally be disposed to treat them in the most favorable manner.

It is assumed by Mr. Verplanck and the committee of 1838, that the revenue of the Erie canal will justify an expenditure of 40 millions, and repay the principal in 30 years; while, on the other hand, Mr. Paige, from official documents, undertakes to prove that the revenue will only pay the interest on 15 millions, with every prospect of a permanent debt to that amount. This great discrepancy arises from the fact that Mr. V. adopted the views of the committee of '38, who state in their report,

> "It will be perceived that the very foundation upon which the financial calculations of the committee are based, is the estimate of the Canal Commissioners submitted to the Legislature, in which they state that the Erie canal, within a few years after its enlargement, will produce an annual revenue of 3,000,000 dollars. The importance of verifying the accuracy of this estimate will be evident, as any material error would lead to the most injurious consequences."

Mr. Paige, on the other hand, instead of adopting the conclusions of the Commissioners, takes the data on which they either did or ought to have established their income of three millions, and demonstrates that there is no probability of the revenue of the Erie canal reaching this sum till the year 1886, without making any deduction for the partial or total repeal of its monopoly of carrying freight, on which exclusive privilege it was shown in a former number that its *entire surplus* revenue depends. The Governor in his late message, as well as the committees of '38 and '39, have placed implicit confidence in the estimated income of three millions, as reported by the Commissioners, while Mr. Paige goes to work as if he neither knew nor cared about any previous calculations on that subject. We have no means of ascertaining why he who knew the merits of the Commissioners so much better than the other gentlemen, should not have yielded the same credence to their statements; but, be this as it may, he has shown clearly that the estimate of three millions gross income from the Erie canal, is utterly unworthy of belief. We must, however, correct one error in this excellent report. It is said, (p. 8,) "The Commissioners cannot be regarded as estimating that the tolls would amount to 3,000,000 dollars in 1846 or 1849, but at a period much more remote." This unhappy attempt at exculpation had been anticipated by the report of the late Comptroller, which appeared more than three months before the report of Mr. Paige. This officer writes and italicizes the remark, (No. 4, Ass. Doc. p. 23,) "*A few years after the completion of the enlargement* may carry us to 1850." The door of escape for the Commissioners is therefore closed, and we are at liberty to choose, as we please,—Mr. Paige's estimate of three millions revenue in 1886, or the Commissioners' estimate of three millions revenue "*a few years*" before 1850.

After proving the inability of the State to complete the enlargement, and the consequent impropriety of any further expenditures, that same senator, the best lawyer in that body, advocates the enlargement, merely reducing the size from 7 by 70 to 6 by 60, a distinction without a difference—for an expenditure which is wrong in principle, cannot be justified by a diminution of its amount by four millions, or 16⅔ per cent, the precise amount leading to a long debate. The same course was also taken by another gentleman, who is well known for the manly stand he has taken against lateral, or, as he very properly designates them, "pauper canals," and thus we find two of the most able members of the Senate advocating a work which they know the State can never complete and can never require. As already remarked of the engineers, it is their misfortune rather than their fault, and the inevitable result of the departure of the government from the high duties of general legislation, and its illegal embarkation in the pursuits of individuals, for these same gentlemen, if members of a board of Directors who were expending *their own* money, would be eminent for sagacity, prudence, and candour.

The Governor in his first message admits the evil, but does not, in our opinion, go to the root of it, though, as it was necessarily written before entering on office, he could scarcely at that time have supposed it possible that he was approving of a system of works based on official data, which it is now only too clear, were never entitled to his confidence. He very truly observes,

> "With the extension of our internal improvements there has been an immense and unlooked for enlargement of the financial operations and the official power and patronage of the Canal Commissioners and the Canal Board. These operations are conducted, and this power and patronage exercised and dispensed, with few of those requirements as to accountability and publicity enforced with scrupulous care in every other department of the government. So inconsistent and unequal are the best efforts to maintain simplicity, uniformity and accountability throughout the various departments, that a greatly mysterious and undefined power has thus grown up unobserved, while the public attention has exhausted itself in narrowly watching the action of more unimportant functionaries. It is a proposition worthy of consideration, whether greater economy and efficiency in the management of our present public works would not be secured, a wiser direction given to efforts for internal improvement throughout the State, and a more equal diffusion of its advantages be effected by constituting a board of internal improvements, to consist of one member from each senate district."

This plan may be attended with some advantages for a short period, but the very nature of the tenure renders it impossible for the State to command the services of agents with the character, capacity, and acquirements of those employed by individuals and companies, as is only too apparent in this State, from the manner in which the enlargement of the Erie canal, and the construction of the Genessee Valley and Black River canals have been "got up."

We will briefly allude to some of the Western States. In Michigan, a private company commenced the only important work which can, for many years, be projected in that peninsula—the Detroit and St. Joseph's railroad. The company, however, could not proceed with sufficient rapidity, so the State "assumed the mantle" of Engineer and Forwarder General, and commenced the construction of a "Northern Railroad," a "Southern Railroad," one on each side of the company's road, now the "Central Railroad," and rendered the *system* complete by introducing the "Clinton canal" between the northern and central lines of railway. These four works average very nearly 200 miles each, the sum appropriated or rather the loan authorized for these 800 miles was five millions of dollars, or 6,250 dollars per mile, about one fourth of the sum required to put them into operation, yet the State has actually entered on the construction of all these works. The result is, that the State, after expending all she has been able to borrow, has only 40 miles of the Central (formerly company's) road in operation, her credit is gone for many years, her farmers must be directly taxed to pay the interest on money expended on works which will never be completed, and the *only* work really required is indefinitely postponed. As in the State of New York, the works projected by the government of Michigan were never thought of by private companies, and it would be as difficult to raise by *private subscriptions* to the stock, 5 per cent. on the probable cost of the "Northern railway," of the "Southern railway," or of the "Clinton canal," as it would be to induce individuals in the State of New York to contribute, as a permanent investment from *their own* means, 2 per cent. towards aiding the government in the construction of the Genessee Valley and Black River canals, or in the enlargement of the Erie canal—that is, impossible.

The State of Illinois received from Congress a valuable grant of land to aid in the construction of the Illinois canal, a truly national work, uniting the Mississippi with the Atlantic by the St. Lawrence and Hudson rivers. This donation would have enabled the State to complete the canal, and the nett revenue might have been expended in aiding private enterprise without the possibility of any tax being necessary, even if all the works which they aided should be as unproductive as the "lateral canals" of New York. *Now* they have commenced a "system" of railroads, the aggregate length of which is above 1200 miles! besides other works. It is unnecessary to state the consequences which have followed, any further than to allude to the sale of the State stocks in New York at 50 per cent, and to the special session of the Legislature which has been called to devise "ways and means" to enable that State to meet its immediate obligations. There is much anxiety to know the course likely to be pursued by the governments of Pennsylvania, Illinois and Michigan, and last, though not least, the city of New York. The Croton water-works are exactly as far from completion as when ground was first broken, for the work which, with *any* quantity of money would require more time than *all the rest*, has just been commenced! Had the Commissioners invested the insignificant sum of 2 or 300,000 dollars from their *own* capital, this would never have occurred, and had this undertaking been left to a company, who should have been bound to expend 20 per cent. on the cost of the work from their *own* means, the citizens of New York would be supplied with "pure" water many years sooner, and at one third of the cost which now appears inevitable.

In some States the grand argument will be, that if they can only *complete* the works commenced, a revenue is immediately certain, which will render taxation to pay the interest unnecessary. That the completion of these projects will make the fortunes of many individuals, is well known, but, for the *permanent interests* of the State, the only plan is, to sell out at once with the present comparatively trifling loss. It is impossible to pay too much attention to the fact, that the greater part of the works projected by the governments of the different States, are not such as will ever be of any essential benefit, and when we add to this, that they are constructed at twice the cost of similar works in the hands of companies, are generally much inferior in execution, and always managed and repaired in the most inefficient manner

Bridge over the James River at Richmond in Virginia, United States of America.

PLATE VIII.

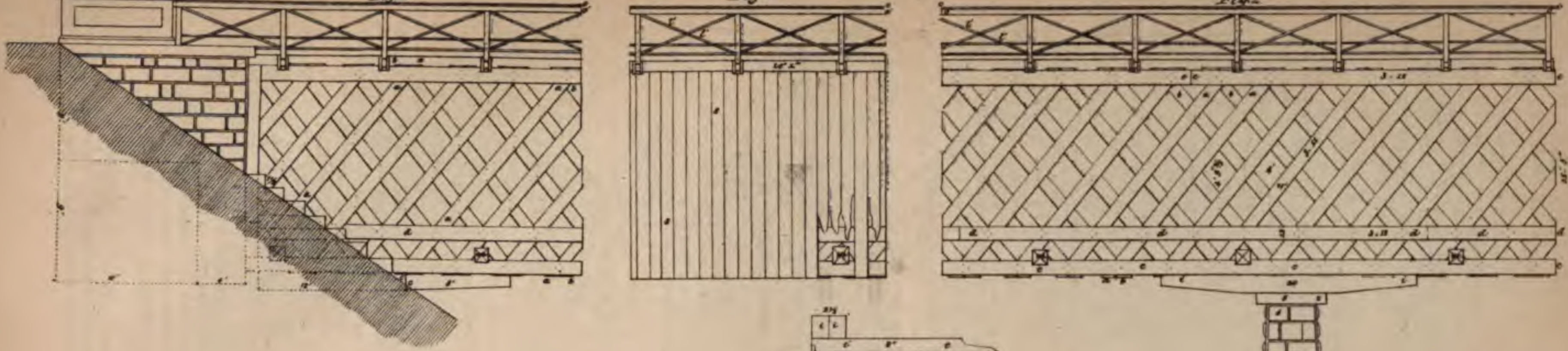


Fig. 2 Fig. 2. Fig. 2

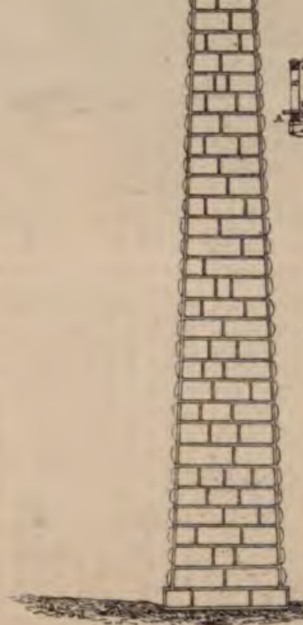


Fig. 4.

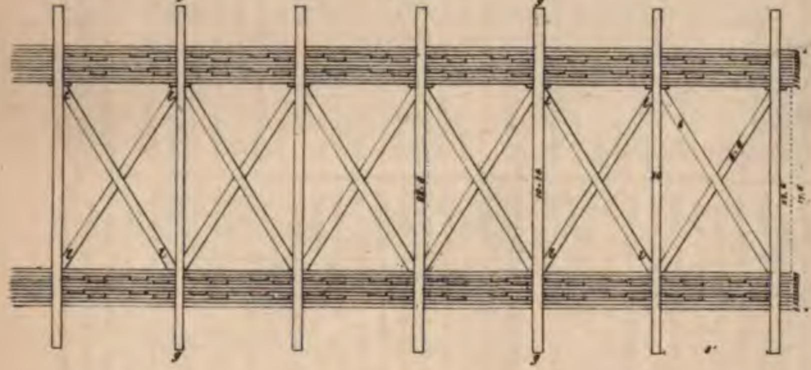
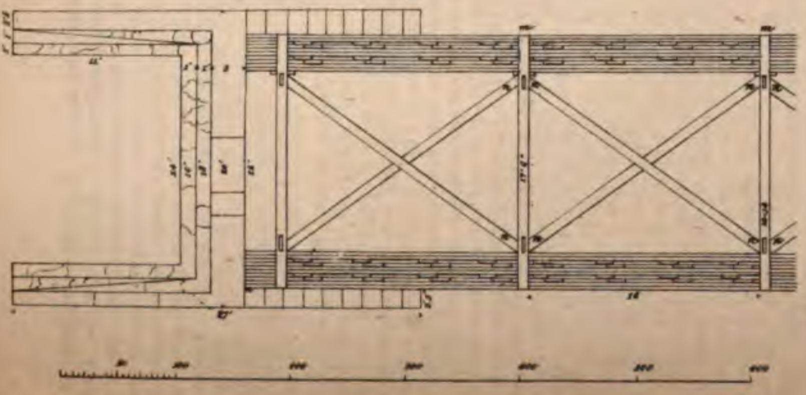


Fig. 5.



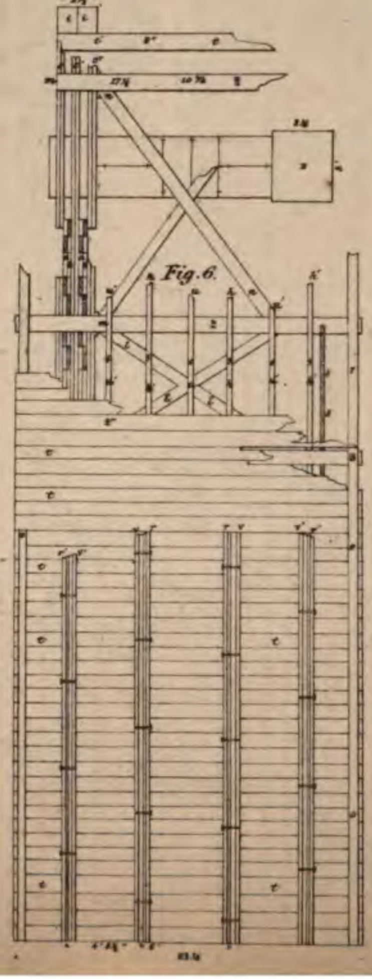


Fig. 6.

Fig. 3.

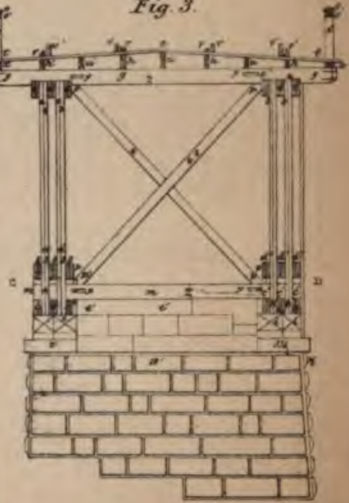
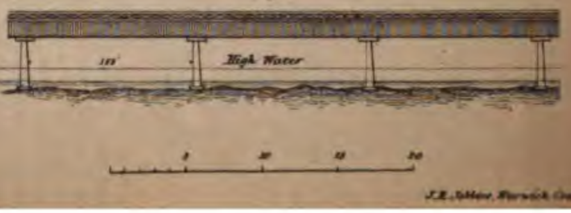


Fig. 1.



J. R. Jobbins, Warwick Court.

—we shall be at no loss to account for the present condition of State works in general. The deficiencies of this year in Pennsylvania alone, are estimated at 1½ millions of dollars, and except the Erie canal, there is not a government work in the Union which has paid the ordinary expenses, including of course, interest on cost. If the Erie canal be placed on the footing of the canals of Pennsylvania, that is, if its exclusive right to carry all the freight to and from western New York, the western States and Upper Canada be abolished, the gross income of the canals of New York will bear a less proportion to the expenditures, than does the revenue of the public works of Pennsylvania to the annual outlays on the internal improvements of that commonwealth. Notwithstanding their financial embarrassments, we are happy to say, that no other State in the Union has resorted to this mode of giving a "delusive prosperity" to their public works, and there is some reason to believe that the long reign of "exclusive privileges" in this State is about to close. By making immediate arrangements for retiring from the construction of canals, the State of New York may yet escape with trifling loss, and with this object in view, the people would readily submit to the present monopoly of freight from the north and west for a few years longer. This appears to us the most judjcious course to be pursued in order to avoid a permanent debt, and it certainly offers an honourable retreat from a position in which it is daily becoming more difficult to maintain ourselves.

The great efforts which have been made by the inhabitants on the line of the New York and Erie railroad, under the most discouraging circumstances, to aid in the construction of that undertaking, show that private enterprize is not yet extinguished in this State, and we have to record the astonishing and gratifying circumstance, that—notwithstanding the different State governments have made every exertion to absorb all the spare capital of this country and of Europe for their own Utopian schemes, the year 1839 has seen more works completed by *companies* than by *States*. Private energy and enterprise have succeeded where the power of government has been unequal to the task, and while the star of "free trade" floats triumphantly on the banners of the Bay State, and indeed throughout New England, we will not despair of seeing, in the Empire State, railways as judiciously projected, as well constructed, as profitable to the proprietors, and as useful to the public, as those of Massachusetts, when they shall be left equally free to the people of the former as they always have been to those of the latter State.

ON TRELLIS BRIDGES.

(*With an Engraving, Plate* VIII.)

We are principally indebted for this paper to a communication of Mr. Moncure Robinson in the *Revue Generale de l'Architecture.*

Mr. Ithiel Town of New Haven, an architect at New York invented a bridge of a peculiar construction which has much the appearance of a bridge invented here by the late Mr. Smart. The principle is one which has been adopted by Seppings in naval architecture. The advantages attributed to it are that bridges with openings of considerable span may be erected with small pieces of wood. These bridges are built on piers far apart and formed of a truss, if it may be so termed, of continuous trellis work, made of planks, double or treble, 10 or 12 inches wide, and 3 to 3½ inches thick, placed parallel to each other at an angle of about 45° to the horizon, crossing nearly at right angles, and alternating from right to left. The angle at which the trellises cross is not strictly a right angle, for the interstices form a kind of lozenge, which if three feet long would be about 2 feet 9 inches broad, which are about the general dimensions. At the crossings the planks are secured with pins. The bottom of the trellis work is strengthened on each side by string pieces running from one end of the bridge to the other, and made also of small pieces of timber 12 inches by 3, in lengths from 35 to 40 feet. The string pieces on each side of the trellis work are double, so that each trellis is secured by four pieces of timber, six inches thick on each side of the trellis. The joints being equally distributed throughout the length of the string piece. At the top of the trellis is a similar string piece running in the same manner the whole length. On the lower strings are placed the transverse beams which carry the timbers of the floor. The upper string piece in the bridges which were first constructed carried the roof.

The trellis work is secured at the crossings by pins of sound oak, an inch and a quarter thick, carefully turned on a mandrel. These pins fit neatly into holes previously bored. They are farther secured by a wedgelike pin driven into their centres on each side. This latter precaution is however only adopted on the more expensive bridges. These pins are two in number at the crossings, and four at the string pieces, they are the only means of securing the timbers to each other, as they are too thin to admit of framing. The only iron work in the whole bridge amounts to no more than a few nails and pins used in some of the joints.

Such was Mr. Town's original plan, and we shall now proceed to describe the improvements which have been subsequently introduced. It is evident that on this system the timbers of the floor may be laid either on the upper or lower part of the trellis work. By laying them on the lower part, the sides and roof may be more readily completed, but the other plan, which has been preferred for railways in the United States, admits of the carpentry being strengthened by horizontal and vertical braces, and gives additional security to the bridge. The ordinary wooden bridges, called in America Burr's bridges, after a carpenter of that name who improved them, are so elastic that the trains can only pass over them very slowly, while on good trellis bridges, particularly those made by Mr. Robinson, locomotives can run at full speed, a great advantage with regard to railways.

The height of the trellis depends on the strength required in the bridge, and necessarily increases with the opening or span. For extensive works where 200 feet span is required, the trellis is made 17 or 18 feet high. Mr. Town recommends that in most cases the height of the trellis should be a tenth or twelfth of the span. When the flooring rests on the string piece the height of the carriages will not admit of the trellis being less than 13 or 14 feet. Some of these bridges have been built of 220 feet span.

Throughout the timbering the two lines which present the greatest resistance are directed, one, following a horizontal right line lead by the lower extremity of the timbering; the other, following a curved arch, which rests by its two extremities on this right line. The trellis bridge has great strength at its base on account of the string piece formed of four pieces secured two and two; but it is not so strong along the upper curve described by the ideal line of the greatest thrust. The more the trellis is raised, the more the upper string piece, which strengthens the timbering, differs from this ideal line. It has therefore been observed that trellis bridges of large span are apt to settle; and once bent, they lose much of their strength. Mr. Town proposed several ways of remedying this inconvenience. To increase the resistance of the trellis, it may be doubled on each side of the bridge; this Mr. Town has tried, separating the pieces of which it is composed, so that the horizontal diagonal of the lozenge between four adjacent trusses should be four feet six inches, instead of three feet. This increases the cost of the wood of each side of the bridge 50 per cent., but on two-way bridges Mr. Town gets rid of the trellis work which he used to place between the two-ways, the quantity of wood remains the same. The string piece may be strenthened by repeating it at the crossing immediately above the pieces of the trellis. In the bridge at Richmond these two methods of strengthening the timbering have both been used. By laying the flooring on the top of the timbering, and by having open bridges, as previously observed, a means of preventing the settlement is obtained, by interior braces. Besides the weight of the roofing is got rid of, which is of little good for railways, where it would be more likely to catch fire from sparks. This danger is particularly to be feared in America, where wood is burned by the locomotives, and so more dangerous sparks are produced than from coke.

Trellis bridges are of the greatest use in the United States, because being formed of thin planking, they can be built in a short time. Thus, for instance, the viaduct by which the Philadelphia and Norristown Railway is carried over the Wissahiccon, 78 feet above the bed of the stream, and 483 feet long in three spans, was built in 68 days. For the same reason the wood required for the trellis work, being easily conveyed, costs less, in many cases, than that required by any other kind of wooden bridge. On the Pottsville and Sunbury Railway, in Pennsylvania, the wood for small truss bridges, for crossing roads is 12 dollars per 1000 feet super and inch thick, which is equivalent to two loads of timber in England. That for trellis work costs only 8½ dollars.

These bridges are formed of pieces all exactly on the same model and of the simplest form, so that all the trusses for the trellis work may be easily cut with exactness by ordinary mechanical means, and the holes bored for receiving the pins. The beams not being at all arched, but flat, it follows that the piers are not subjected to the lateral thrust, to which they are exposed in other bridges; and they only require a thickness necessary to resist the vertical pressure represented by the weight of the bridge.

Trellis bridges are very much increasing in use in the United States; a dozen years ago, one of 2200 feet length in ten spans was built over the Susquehannah, at Clarke's Ferry, near Duncan's Island, just above Harrisburg, the capital of Pennsylvania. One of 1530 long was built over the Hudson, at Troy, in the State of New York, for the railway from Troy to Ballston Spa. The chief spans are 180 feet. It is divided into two ways, each 15 feet wide, and separated by an additional trellis. It is made with the flooring at the bottom, and double trellises at each side. In 1835, others of great span existed at Newbury Port, Northampton and Springfield, all in Massachussetts, at Tuscaloosa in Alabama, at Providence, &c., and since then many more have been built.

The price of the timber for the Troy Bridge, including every thing but painting, is 18·25 dollars per foot. The piers are of fine blue limestone. The flooring is 30 feet above low water. The Tuscaloosa bridge is four spans of 220ft. each over the black Warrior River. The height of the trellis is 16ft. and it cost 6400*l.* It was opened in December 1834; and has stood well against the traffic which has passed over, particularly large herds of cattle. Another bridge of the same construction of large span is at Nashua, in New Hampshire, thrown over the Merrinack, The bridge across the great Conestogo to carry the Philadelphia and Columbia railway, as it formerly stood was 1412 feet long, and in nine spans of 150 feet. Its breadth was 22 feet, and the flooring rested on the string piece. This bridge was much too weak, the trains could run but slowly on it, and the trusses were only 2 inches thick, so that it has recently been obliged to be rebuilt.

Mr. Robinson prefers trellis bridges, and the many railways he has constructed to those of any other construction, and has introduced considerable improvements into them. That at Richmond is the most remarkable which he has built, and is distinguished as a first rate piece of carpentry, even in America where this mode of construction is carried to such perfection. This bridge stands without the town of Richmond, on the railway from that town to Petersburgh, forming part of the grand line from north to south through New York, Philadelphia, Baltimore, Washington, Fredricksburgh, Richmond, Petersburgh, Raleigh, and Charleston.

Bridge over the James River at Richmond in Virginia, United States.

This bridge was commenced in December 1836, and finished 5th September 1838, it was built by Mr. Sandford, under the directions of Mr. Robinson the engineer. It was erected a little below the magnificent cataract of the James River at Richmond, where the river is very broad, but not very deep flowing over the bare rock which forms an excellent foundation for the piers. The banks on each side of the river are very steep, which rendered it necessary to erect the bridge at a great height above the water.

The bridge is 2,844 feet long between the abutments, and contains 19 openings, which vary in their spans, one span is 130 feet, four 140 feet, four 150 feet, and ten 153 feet span from centre to centre of pier. The superstructure is entirely of timber, erected on the top of piers built of solid granite, rough scabbled on the face, and with rustic grooves at the joints; these piers are only 7 feet 6 inches thick by 21 feet long, on a level with the low water-mark, they batter all round to the top, which is 4 feet thick by 18 feet long on the plan; the height is 40 feet above low water-mark, and to the top of the rails is 20 feet more, making a total height of 60 feet.

Plate VII, fig. 1, is an elevation of the centre arches drawn to a very small scale.

Fig. 2 is an enlarged view of different parts of the elevation, showing the details of construction.

Fig. 3 is a transverse section of the carpentry.

Fig. 4 is a horizontal plan of the carpentry, one part exhibits the rails and floor, another part the joists, girders and wind braces.

Fig. 5 is a horizontal plan of the lower girders and wind braces, together with one of the abutments, and also the top of one of the piers.

The carpentry of the superstructure consists of a continuous double trellis work, 15ft. 6in. high on each side, and running from one end of the bridge to the other, with a triple string at the top and bottom, and another above the lower girders, each consists of two 3in. planks 12 inches deep. The trellis work is formed of 3in. planks 11 inches wide crossing each other and pinned together with two pins at each crossing, and with 4 pins at top and bottom to the string pieces. The whole thickness of the trellis work including the string pieces is 2ft. 6in. and the width between, under the roadway, is 12ft. 6in making a total width of 17ft. 6in. from outside to outside of the trellis work.

On the lower string pieces are placed transverse girders (tie beams) *m*, *m*, 14 by 10 inches, and 17ft. 6in. long and 16ft. apart from centre to centre; on the top of the trellis work are placed similar girders *g*, *g*, 22ft. 6in. long; the extremities of which are notched or caulked down to the top of the trellis work; upon the girders the joists are laid longitudinally, upon which is the flooring of planks inclined from the centre to the sides, the whole breadth of the top of the bridge is 23ft. 4in.

Upon the top of the floor are placed the rails, *r*, *r*, for two lines, they are of timber, 5 inches square, capped with an iron bar 2 inches wide by ½ inch thick, and for the the security of the trains, each rail is provided with a guard rail of a similar scantling, the guard rail at the bottom is in close contact with the rail, but at the top there is a space formed for the wheel, the width between the rails is 6 feet.

Between the upper and lower girders are fixed horizontal diagonal wind braces, *l l* which are morticed into them, there are also vertical diagonal braces, between the top and bottom girders, which render the whole of the bridge very stiff.

On the top of each pier are two capping stones 12 inches thick and 5 feet long by 3 feet 6 inches wide, which project over the pier 6 inches, on these stones are templates of timber to carry the trellis work.

The whole quantity of iron introduced in the bridge is less than a ton weight.

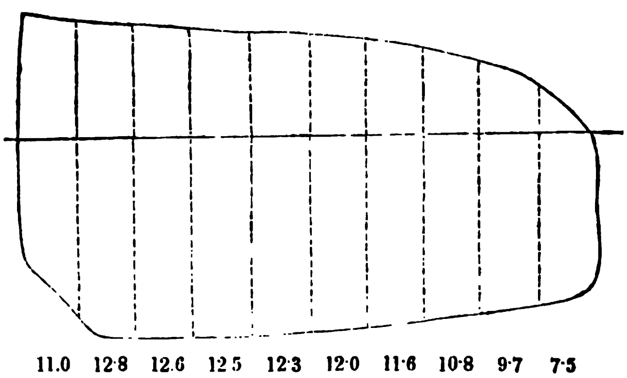
The following table of scantlings will explain together with the references and the drawings, the general construction of the bridge.

DESCRIPTION.	QUANTITY.	SCANTLING IN INCHES
Ribband for hand railing *o' o'*	5,800 feet run	2 × 8
Cap ditto, *o o*	5,800 ditto	5 × 5
Posts ditto, *x x*	720 pieces 5 feet long, 5 × 5 and 5 × 8 mean	5 × 6½
Braces ditto, *l' l'*	1,440 ditto 8 feet 6 in. long	2 × 5
Guard rails, *v v*	5,800 feet run	5 × 8
Ditto, *v' v'*	5,800 ditto	5 × 10
Bearings rails, *r r*	5,800 ditto	3 × 5
Ditto, *r' r'*	5,800 ditto	5 × 5
Flooring planks, *t t*, *t' t' t'*	67,200 feet super.	2 × 12
Flooring joists, *u u*	2,900 feet run	4 × 12
Ditto, *u' u'*	5,800 ditto	4 × 10½
Ditto, *h h*	5,800 ditto	5 × 11½
Ditto, *h' h'*	5,800 ditto	5 × 9
Ditto, *x' x'*	5,500 ditto, in pieces 7 feet 7 inches long	7 × 7
Top girders, *g g*	360 pieces 22½ feet long	10 × 14
Top braces, *l l*	720 ditto 15 ditto	5 × 6
Chords or string pieces, *c*, *c'*, *c''*; *d*, *d'*, *d''*; *e*, *e'*, *e''*	2,850 ditto 36 ditto	3 × 12
Lattices, *a a*, *a' a'*; *b b*, *b' b'*	5,700 ditto 21½ ditto	3 × 11
Vertical braces, *p p*	360 ditto 18½ ditto	6 × 6
Bottom girders, *m m*	180 ditto 17½ ditto	10 × 14
Bottom braces, *n n*	360 ditto 20 ditto	5 × 8
Support timbers (templates) *ii*	80 ditto 20 ditto	18 × 18
Pieces to nail on weather-boarding, *s' s'*	5,800 feet run	3 × 6
Weather-boarding, *s s*	95,000 feet super.	¾ × 12

PRACTICAL ILLUSTRATIONS OF THE METHOD OF INDICATING THE POWER EXERTED BY STEAM-ENGINES IN FACTORIES.

Sir,—In pursuance of this subject, perhaps I cannot do better than give detailed examples of cases in actual practice, as more likely to be of interest to practical men. With this view I have recently been furnished by a friend* with the annexed diagrams (Figs. 1 and 2),

Fig. 1.

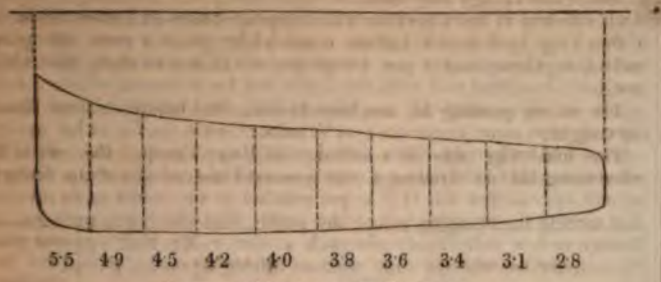


Average 11·28 lbs. per circular inch.

---

* A correspondent of your Journal, Mr. David W. Bowman, a young engineer of great promise, now on his way to South America.

Fig. 2.



Average 3 98 lbs. per circular inch.

together with an abridged extract from a report of an Indicator experiment made by him on one of Boulton and Watt's old 40 horse engines, now working in a cotton factory in Manchester, and also including some remarks thereon which seem pertinent to the subject of my last letter.

This engine has a cylinder 31½ inches diameter, 7 feet stroke, and a speed of 260 feet a minute. The diagrams were taken by Macnaught's Indicator, the scale of which is $\frac{1}{10}$ of an inch to each pound per square inch of pressure, or, which is the same thing, ·07854 of a pound per *circular* inch, the latter is the scale used, as it greatly abridges the calculation. Fig. 1 was taken when the whole of the machinery was at work in the usual way, and being measured, it gives an average for the gross pressure of 11·28 lbs. per circular inch. Fig. 2 was taken when the whole of the machinery was thrown off, the load of the engine then consisting only of the friction of the shafts, gearing, and straps running on the loose pulleys, together with the power required to work the engine itself. This figure, being measured, gives an average pressure of 3·98 lbs. per circular inch, for the friction of the engine, shafting, &c., which, deducted from the gross pressure, leaves 7·3 lbs. per circular inch for the net effective pressure.

The velocity of the piston, 260, drawn into the area of the cylinder, $31{\cdot}5^2$, (=992·25 circular inches,) =257,985, and this number, divided by 33,000, gives 7·8 horse power, for each pound pressure per circular inch. This, again, multiplied by the nett effective pressure as above found (7·3 lbs.) gives nearly 57 for the "nett effective indicated horse power" then exerted by the engine.

The following remarks are extracted from Mr. B.'s report:—"The power consumed by the shafting unloaded seems enormous, but as there is an immense quantity of it, and a number of the steps, I am told, are not in very good order, and the straps, too, being probably very tight, I am inclined to think that the result given by the indicator diagram is not far from the truth. This result, which is usually called *available power*, means all the power that is exerted by the engine, exclusive of what is absorbed by the engine, shafts and straps; but it would be a mistake, however, to suppose that all this available power is delivered (so to speak) at the machine pulleys, for as the work is put on, the friction is increased through all the ramifications of the shafting, and the amount of this increase, which we have no means of ascertaining, must be deducted from what is called the available power, if we wish to know the amount of power consumed by the *machinery alone*. It is a good practice, however, to debit the machinery, not only with the power consumed by itself, but also with the power required to overcome the increase of friction along the shafting, and this I have done, calling them together available power. It is not a good term, and another wants substituting in its place. It is manifest, therefore, that a great quantity of shafting should be avoided, both on account of the power lost in turning the shafting itself, but also on account of the *increased increase* of friction when loaded."

The following is a list of the machinery, as furnished by the manager of the works:—

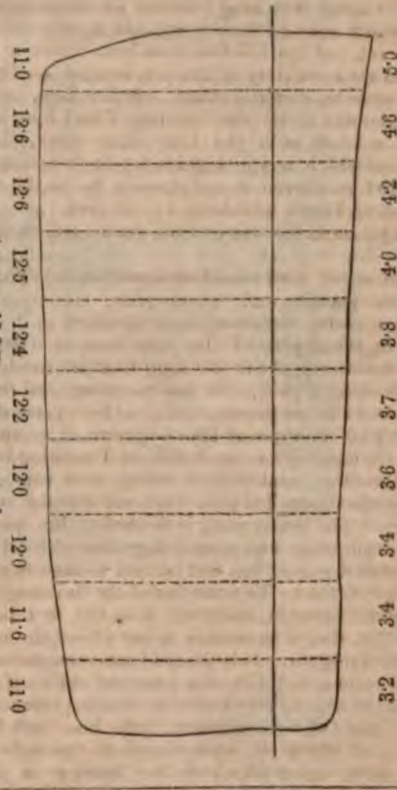
4 Pair of Mules, 648 spindles each.
1 Pair ditto 1080 ditto
8 Throstles 180 ditto
164 Calico Looms, 120 picks a minute.
60 Double Carding Engines, 50 inches each.
3 Drawing Frames, 14 rollers each.
6 Dyer's Frames.
1 Willow and Lap Machine.
Winding and Warping.
1 Mechanics Shop with Lathes and Grindstone.
63 Tape Looms, 25 pieces each.
11 Braiding Machines.
2 Tape Callenders.
1 Winding Machine.
2 Lathes and Grindstone.

Besides the above, there is a 9 inch pump 28 feet deep, which is included in the engine and shafting friction.

The remarks of Mr. Bowman bear evidence to the necessity of a nicer distinction in the technical terms used respecting the power of steam engines than has generally been admitted by engineers, and which necessity it was partly the object of my last letter to point out. The above list of machinery will also, I hope, be useful to mechanical engineers or others, who take an interest in the statistics of the steam engine. But I must observe that this engine must by no means be taken as an average specimen of the factory engines in Manchester; for as regards economy of steam, and consequently economy of fuel, it is considerably below that average. Indeed, I believe a worse case will not be easily found in any regular factory in Lancashire; and this is, in fact, one reason why I have selected it, for the serious consideration of those advocates of the expansive system who are continually boasting that the engines in Cornwall are doing five or six hundred per cent. more work for the same quantity of fuel than is done in any other part of the kingdom;* and also in order that there shall be no longer any mistake in this matter. Let any Cornish or other engineer point out clearly, how, even so little as 50 per cent. more work is to be done by the steam that the above engine uses, or a saving of one third of the fuel, and I know the owner of the engine will be very much obliged to him. I can find many factory owners that would be very glad to save even 10 per cent. in fuel at the present time, in addition, of course, to the ordinary interest of money for the capital required to be expended in adopting the improvement.

In the town of Manchester, owing to the difficulty of getting a sufficiency of cold water, the steam-engines are generally doing a much less duty than in the cotton-factory district surrounding it, where it is not uncommon to find them using about 6 pounds per horse per hour on the effective, or 9 lbs. on the nett effective indicated power. The diagram Fig. 3, which was sometime ago given me by my friend Mr.

Fig. 3.



Average 15·8 lbs. per square inch.

---

* In a Cornish newspaper now before me (called "Lean's Engine Reporter and Advertiser,") for November, 1839, is inserted an extract from the Athenæum, in which it is stated "that *five* times as much work has been done by a Cornish steam-engine as by an *excellent* Boulton and Watt's engine on the common system; or that the same amount of work is done with one fifth part of the expense of fuel! A statement *almost* incredible, yet perfectly true." It is, indeed, "almost incredible" to me, that the respected authors of the Monthly Reports should allow such assertions to pass without note or comment.

William Elsworth, of Preston, was taken by him from an engine belonging to Messrs. Horrockses, Miller and Co. of that town, working with about that rate of consumption. This engine is perhaps a fair average of the best engines in Lancashire, or such a one as might with propriety be compared to the average of those in Cornwall, whose duty is reported, in any question relating to the advantage and economy of the expansive system. I do not know the particular dimensions of this engine, but Mr. E informed me that it was then working at an effective indicated power of above 150 horses, which was about double its nominal power, as, indeed, appears evident from an inspection of the figure, which is measured by Macnaught's scale of $\frac{1}{10}$ of an inch for each lb. pressure per square inch, the vacuum averaging 11·99, and the steam 3·89, making a total gross pressure of nearly 16 lbs. per square inch. The temperature of the cold condensing water was 76°, and that of the hot well was 115°, at the time of the experiment.

I am, Sir, your obedient servant,
R. Armstrong.

Manchester, 14th March, 1840.

IMPROVEMENTS IN BIRMINGHAM,

With an Engraving Plate ix.

(From a Correspondent.)

Among many improvements which have lately taken place with reference to the public buildings of the town of Birmingham, are its magnificent Roman temple as a town hall, the grammer school, a splendid building in the Gothic style, the new churches, capacious market hall, railway stations, and several banking houses, all possessing architectural embellishments of no mean character, to these we may add Warwick house, the Drapery and Furnishing establishment of Mr. W. Holliday, just on the eve of completion, from the designs of Mr. W. Thomas, Architect. This building from its central situation in New-street its height, its extent of frontage, beauty of design and richness of detail may be justly entitled one of the ornaments of that improving town.

The annexed view is a perspective representation of the front as seen from the opposite side of the street, The design is in a style more than usually luxuriant, and the building occupies a frontage of 54ft 6in. in width and 55ft in height; the whole pile covering an area of 5,777ft. By reference to the engraving it will be seen that the shop front is divided into three compartments, by rusticated and empannelled ellongated Doric pedestals or pilasters of stone supporting coupled lions on each, the size of life; they carry the enriched entablature of the shop front, the part over the lions breaks forward and is likewise in stone with enriched modillions. The sashes are of massive brass, glazed with plate glass, the squares are in one height in single plates, the dimensions of which in the centre division are 11ft. 2in. by 3ft. 2in. and to the side division 11ft. 2in. The upper part of the building above the shop front is also divided into three divisions consisting of a centre and two wings, at the angles of the latter are antæ or fluted pilasters, and in the centre division are two three quarter fluted columns of the composite order, the height of two stories, (the example from the baths of Diocletian at Rome,) supporting an enriched entablature. Above is a very richly decorated attic with enriched panelled pilasters semi circular headed windows, ornamented with carved masks, and shells, the whole surmounted by an open scroll parapet over the wings, and carved panels in relief, representing foliated Griffins, masks, and foliage in the centre, with pedestals and acroteria. The interior of the building is fitted up with a corresponding degree of richness. It is 10) feet in depth and divided into three shops, the centre is the principal department, fitted up in a splendid manner. It is divided into compartments by marbled Corinthian columns and pilasters supporting enriched entablature and ceiling, at the extreme end there are similar columns and pilasters with a centie plate of looking glass, 10ft. 1in. high by 3ft. 6in. To the left is the furnishing department and to the right is the French department, connected with which is a cloak room furnished with a looking glass, 8ft. by 6ft. and a painted glass window 9ft. 3in. by 8ft. representing Trade, Commerce, &c. The fixtures are of riga oak. The back part of the building is lighted by lantherns, glazed with plate glass, the basement is occupied with warehouses, and in the upper part of the building are the dwellings for the proprietor and the numerous establishment.

THE PATENT WATER ELEVATOR.

Sir—I had a few days since an opportunity of examining a model of Hall's Patent Water Elevator, which appears calculated to overcome any difficulty in raising water to any required height at a very trifling cost; with the principle of it you are no doubt well acquainted, and I should not have troubled you with this letter but for a remark which a friend made on my naming the machine to him, he immediately recollected having seen some years since at Windsor Castle (as far as his memory serves him) what was then called "the Rope Pump," the only difference being that at Windsor a rope was used instead of a strap, from this it will appear that Mr. Hall is not entitled to any credit as an inventor, but merely for bringing before the public that which was probably only known to few individuals—In such a case is Mr. Hall's patent good? Or can any one use the rope without infringing on his patent?

I am, Mr. Editor,
Your faithful Friend,
An Original Subscriber.

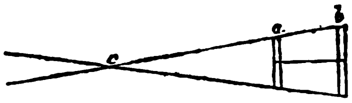
Leeds, March, 18, 1840.

⁂ We are decidedly of opinion that the use of the rope would not be an infringement of the patent. We are not very favorable to either the belt or the rope, as an economical mode of raising water. Editor.

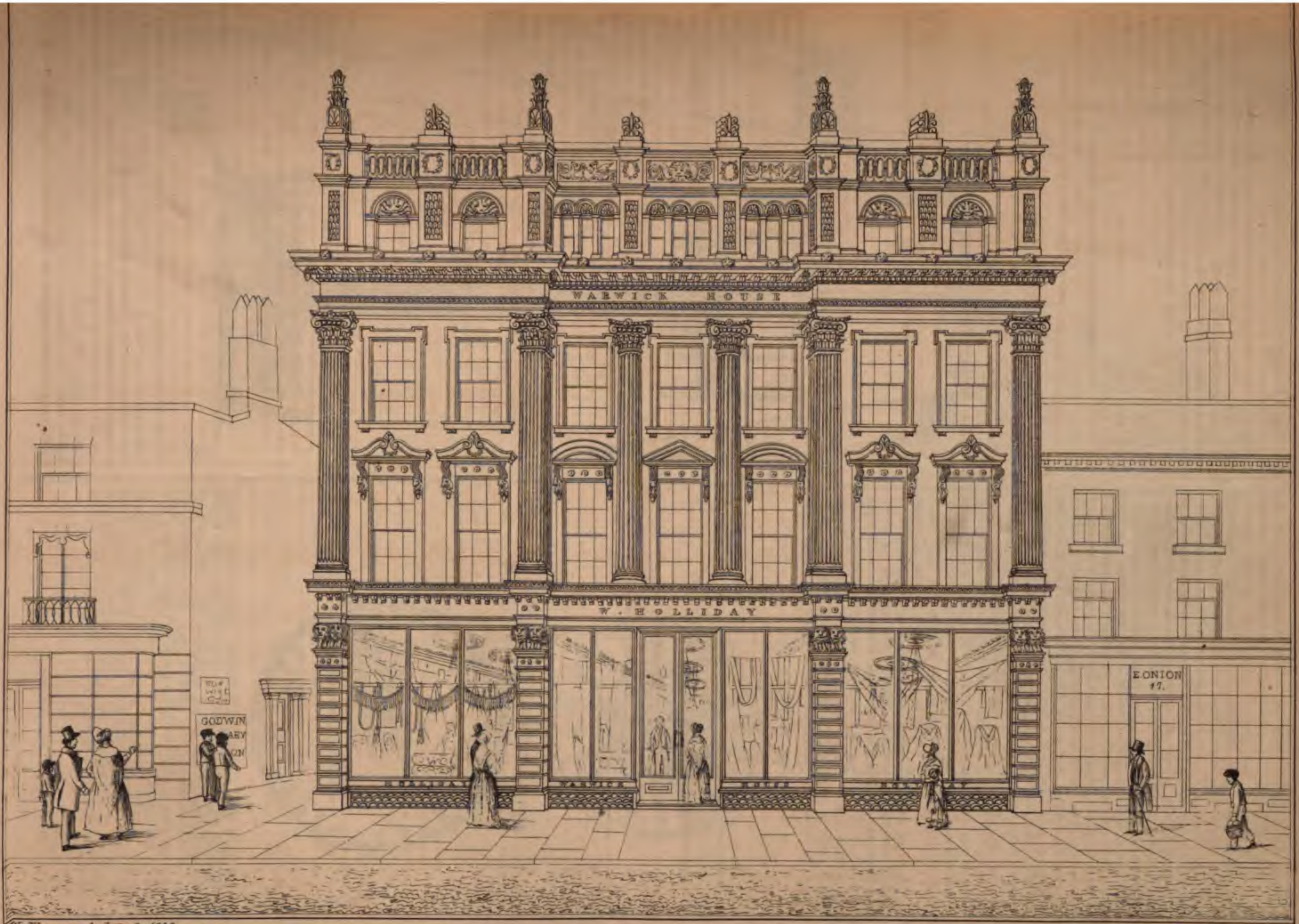
DR. LARDNER'S LECTURES ON RAILWAYS.

Sir—No doubt many of your readers have heard of the Lectures lately delivered at Liverpool and Manchester, by Dr. Lardner, "on the resistance to railway trains, the effects of gradients, and the general economy of steam power,"—he might have added a detailed statement of the profound ignorance of engineers on these points. Among other subjects he introduced that of conical wheels, and endeavoured to show that all engineers had fallen into an egregious error in supposing that the cone was of any service in enabling a carriage to move in a curvelinear direction, he said "never was there a more consummate mechanical blunder, the cone could do literary nothing; for they had left out of view the fact that the parallelism of the axles was preserved, and until they cease to be parallel the cone could do nothing. If a model carriage were constructed, with the wheels on one side small and on the other large, and the axles parallel, that carriage would not make so great a mechanical blunder as the engineers had done, &c."

Now, with all due deference, I must beg to dissent from the Doctor in his practical deductions: and I shall endeavour to show that the cone is practically the instrument by which carriages traverse curves. We know that if two wheels of unequal diameters be placed upon an axle and made to revolve, that the whole will describe a circle having for its centre that point where two lines drawn through the extremities of the diameters of the two wheels intersect thus.



c is the centre round which the pair of wheels *a* and *b* would revolve and if there be another pair of wheels having the same relative proportions and their axle pointing to the same centre, and suppose these two pair of wheels to be connected by means of a carriage body, which would only slightly interfere with the conveyance of the axle, it is evident that the tendency of the wheels to move in the curve would exercise a force to preserve the condition necessary to do so; now my own impressions have always been that the tangential motion of the carriage would at first bring the outer wheel upon a diameter so much greater than the inner one, that its greater progression would exert a force sufficient to cause a deviation from parallelism in the axle which would suit the curve, the outer wheel will not slip unless the resistance to the axle assuming a convergence suitable to the curve, be about a $\frac{1}{40}$ of the insistent weight, which calling the weight of the carriage 5 tons would be $\frac{2800}{40}=70$ lb. on each journal or wheel. The curves used on railways are seldom less than 1 mile radius. If we call the distance between the axle 10 feet, which is more than they generally are, and taking the width of rails at 5 feet, we shall have the deviation from parallelism of the axles in order to point to the centre of the curve $\frac{10}{5280}$ft. × 5ft. = 0·11in. and as they revolve in four bushes, which bushes are con-



W. Thomas Architect 1839.

G. Walker Lithog. Union St. Birmingm

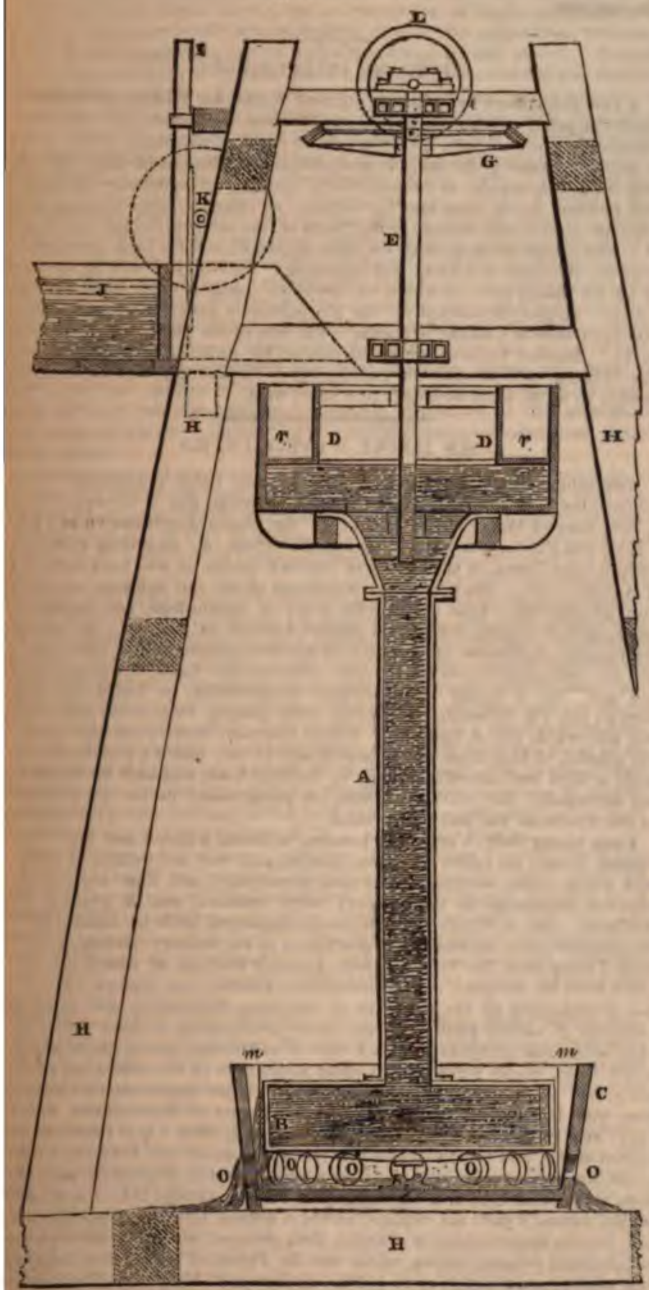
WARWICK HOUSE,
NEW STREET, BIRMINGHAM.

nected to the body of the carriage by means of springs, and kept in their places by guide plates, so that it is only necessary for the tendence to move in a curve to exert a force sufficient to alter the position of each journal, $\frac{11}{100}\times4=\frac{11}{400}$ of an inch, in order to pass round a curve a mile radius solely by the influence of the cone, a quantity so small that the Doctor will find great difficulty in persuading practical men that it is "*impossible*" such a deviation can take place, more especially as we see a force equal to 700lbs endeavouring to produce it.

Inquirer.

VERTICAL WATER-WHEEL.

Fig. 1.—Elevation.



The accompanying engravings represent a vertical water-wheel, pon the principle of Barker's mill, which I erected at the ironorks of the United Mexican Mining Association at Durango, in Iexico, in 1832, for the purpose of driving a circular saw; it was esirable to produce a rapid movement without the intervention of earing, and this not being possible by means of the breast wheel, hich was, besides, fully loaded with the blast machinery, it occurred to me to avail myself of Barker's mill; I first formed a rough working model, upon the usual construction, but found the action of it so very feeble, that I surrounded the arms with boards, in order that the flowing water might impinge against them; this arrangement quadrupled the velocity of the machine: I then added the upper part, which was a still further improvement. The height of fall was about 8 feet, the bore of the pipe about 12 inches, the length of the legs about 30 inches from the centre, the size of the orifices about 6×2= 12 square inches, the velocity 40 revolutions a minute; by the period it was completed and set to work, the works were suspended, so that nothing further was done with it; I had an ulterior object in view in constructing this machine, viz. to devise some simple and efficient means of working the "tahonas," or grinding mills used in the reduction of the silver ore in the mining districts; this wheel would have been in these cases invaluable, as it was formed entirely of timber, excepting the step or shaft, and the few bolts and hoops with which the tube and legs were bound together; it would never have got out of order, and could not have been broken by any, but a wilful accident; any country carpenter could make it, and keep it going, and it required noheavy or large timber in its construction, for it can be supported as well by a wall, as the timber framing shown in the drawing.

Figure 1 is an elevation, the wheel and water-course shown in section. Fig. 2, a plan of the upper wheel, and Fig. 3, a plan partly shown in section of the legs and tube.

The same letters refer to each figure, so far as the parts are shown in each. A is the vertical pipe, mounted on the box B, forming the legs, the water issues from each extremity, and impinges with great force against the fixed floats *n*, *n*, &c., of the fixed tub *c*, and ultimately escapes through the holes *o* cut in the bottom of the tub. Upon the upper end of the pipe a cross frame is fixed, which carries the horizontal or upper wheel, which has furnished all round its interior circumference vertical float-boards *r*, and horizontal floats *n*, which form cells, the water escaping into the tube through radiating openings left in the bottom as shown, thus advantage is taken of the momentum of the water rushing into the wheel. E is the vertical shaft, upon which the crown wheel G is hung, working the pinion L, which conveys the motion of the wheel, through the medium of its shaft, to the mill; J is the water and water channel, I the sluice, K the pinion to lift the sluice, H the framing by which the wheel is supported; the movement of the wheel is in the direction of the arrows shown in Fig. 2, and the reverse of those shown in Fig. 3.

Fig. 2.—Plan of Upper Wheel.

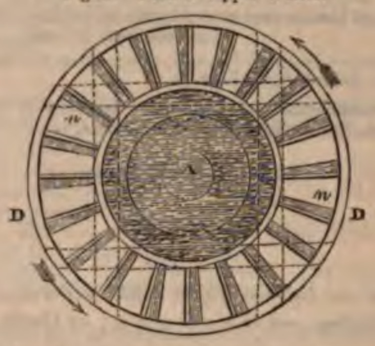
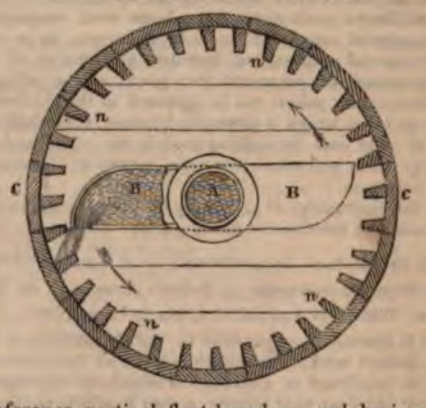


Fig. 3.—Plan partly shown in section.



15, *Stamford Street*. W. J. CURTIS.

COMPETITION DESIGNS.

SIR—Observing in your Journal of this month, a communication from Mr. Wyatt, which contains a correspondence between Messrs. Wyatt and Brandon and the Committee for building the proposed New Church at Cardiff, wherein my name is frequently introduced, I feel called upon in justice to my own professional character, to offer the following explanation, by which I think Messrs. W. and B. will be induced to view the circumstance in a different light to that in which they now regard it.

The first fact which I shall allude to, in order to remove any impression that may exist, as to my plan having been selected from personal preference, is, that I was an entire stranger to every one of the committee until after the adoption of my design had been determined on. Upon my enquiring (which I did at my first interview), how it was that the premium had been awarded to another, when my plan was considered the best, I was informed that the committee, anxious to do all in their power to insure justice to the several parties who had intrusted them with their designs, had submitted the several plans to two gentlemen in London, eminent in their profession, and that they had strongly recommended the adoption of my design, but considered I was not entitled to the premium, through not having, as *they thought*, acted in strict compliance with that portion of the advertisement which directed that the principal front should face Bute-street: and they concluded that this could not have been my intention, because the altar would not in that case have been at the east end of the church.

In this respect however my intentions were misunderstood, in consequence of my East Elevation having been described "Principal Front," instead of Front facing Bute-street, and in thus deviating from the usual custom of placing the Altar at the East-end, I considered I had sufficient precedent in the many Churches recently erected in which the Altar is not so placed.

Had this explanation taken place before the premiums had been awarded, Messrs. W. and B. would have been spared the unpleasant correspondence they have had with the Committee on the subject, as I should in that case have received the premium, as well as the appointment of Architect to the Church.

Your insertion of this in your next Journal will oblige, Sir,

Your obedient Servant,

THOMAS FOSTER.

4, *Park-street, Bristol, Feb.* 17, 1840.

*** This communication ought to have appeared in the last month's Journal, but it was accidentally omitted.—EDITOR.

REVIEWS.

On the Use of the Improved Papier Mâché in Furniture, in the Interior Decoration of Buildings, and in Works of Art. By Charles Frederick Bielefield.

This is not, as our readers might think, an exclusive catalogue of Mr. Bielefield's well known productions, but a large work containing engravings of above 500 approved ornaments used by architects, so as not only to be available for its special purpose, but useful to all members of the profession. As a work of reference or ornament this possesses the advantage that any design the architect may select, can be obtained at the shortest notice, while of these given in other works it generally happens that they cannot be obtained except at great cost for making models, &c. The architect can from these engravings select and combine a great variety of valuable specimens in every class of ornament.

Prefixed to the engravings is a history of the manufacture, to which we shall have occasion to refer in our next number.

Geometrical Propositions Demonstrated, or a Supplement to Euclid, being a Key to the Exercises appended to Euclid's Elements. By W. D. COOLEY, A.B. London: Whittaker and Co., Ave Maria Lane, 1840.

The present is scarcely a supplement to the able edition of Euclid by Mr. Cooley, but a distinct work, intended to impress on the public the true value of geometry—its excellence as a method of reasoning and training the mind. The author well observes, that merely to read Euclid is not to become a mathematician, nor to attain all the advantages to be derived from geometrical studies, that we must not stop short, but carry out the methods of reasoning of which examples are afforded to us by that valuable work.

Guide to Ornamental Drawing and Design. By J. PAGE. London Berger, 1840, Parts 1 and 2.

This work is one of the best and cheapest which has been written on the subject, and from the pen and pencil of a practical man, who has had the advantage of being able to see his instructions carried into effect under his own inspection, as Director of the Class of Ornamental Drawing, in the School of Design, at Saville House. If it were any recommendation to the work it might be mentioned that the illustrations proceed from the graver as well as from the pencil of Mr. Page.

The Year Book of Facts in Science and Art. By the Editor of the Arcana of Science. London: Tilt, 1840.

We are too large contributors from our own columns to this valuable record of the progress of science to view its improvement and success with any other feeling than that of congratulation. We sincerely recommend this work to our readers as one of the best condensations of valuable facts in science and art.

Claverton Inn.

This is an engraving of a building, built by George Vivian, Esq. on his property near Bath. It is in the Italian Villa style, and though not quite pure is a most interesting edifice. The outline is worked sufficiently without being frettered up, and has a most picturesque effect in harmony with the surrounding scenery. It is a good study.

Specimens of Wood Engravings. by THOMAS GILKS.

Pleasing examples of this interesting art, and creditable to the talents of the engraver.

LITERARY INTELLIGENCE.

A new publication by Schinkel, entitled Werke der Baukhunst, is about to appear in parts, at intervals of four months from each other, and will be more elaborately executed than his Entwürfe, as some of the plates will be printed in colours. Among the subjects promised are the designs for king Otho's palace, on the Acropolis at Athens, which though not adopted,—the building now erecting being from one by Gärtnor, of Munich, may be expected to prove of no ordinary interest, some parts of the interior having been spoken of as exceedingly striking, both for their originality and for their extraordinary richness, in regard to gilding and colouring. This subject will be illustrated by twelve plates, some of which will probably contain two or three drawings. Another subject mentioned in the prospectus is prince Albert of Prussia's palace, or villa of Camenz in Silesia. The size of the plates will be 26 inches by 15. Another German work announced for publication is Ehrenburgh's Bau Lexicon, or Dictionary of Architectural terms, &c., of which we shall be able to speak more at length in a short time.

SIR JEFFRY WYATVILLE, R.A.

THE subjoined memoir we have derived from Fisher's National Portrait Gallery, the Literary World, Art Union, Athenæum, &c.

SIR JEFFRY WYATVILLE, Knight of the Saxon Ernestine Order, R.A., F.R.S., and F.S.A., was the son of Joseph Wyatt, an architect, resident at Burton-upon Trent, in the county of Stafford, where he was born on the 3rd of August, 1766. His father was considered clever, but indolent, and, therefore, afforded but a poor example for a boy of enthusiastic and enterprising spirit, such as young Jeffry soon proved himself to possess. He received the common rudiments of education at the free-school of his native place; and his early passion was for the sea. During this time, he was once "rigged out" for a voyage with Admiral Kempenfeldt, on board the *Royal George*, but was fortunately prevented from joining that noble ship, which was afterwards lost at Spithead. Home, however, became not only irksome, but painful, to him, from the improvidence of his father; and, in 1783, he made a third and succesful attempt to fly from both, and seek his fortune in the metropolis; but could not obtain any engagement in the naval service, as the American war had then ceased.

Upon young Jeffry's arrival in London, he found a friend and protector in Samuel Wyatt, his father's brother, then an architect and builder of repute; with whom Jeffry continued more than seven years, and thus acquired considerable knowledge of the ordinary office business, and of practical construction. Mr. S. Wyatt was extensively employed, both in London and at the seats of many noblemen and gentlemen in the country, namely, at Eaton Hall, Tatton Hall, the Trinity House, London, &c., all of which were executed from his designs; and, consequently, afforded his nephew opportunities of witnessing all the processes of designing, estimating, and executing, buildings of various kinds. In the hope of acquiring further professional knowledge, and particularly with a view of cultivating that essential requisite in art, taste, young Wyatt sought these advantages in the offices of another uncle, Mr. James Wyatt, who had attained a higher station on the ladder of fame than his brother. He had passed some years of architectural study in Italy, and, while yet a minor, he designed and built "the Pantheon," in Oxford-street, and was introduced to the appointment of Surveyor-General of his Majesty's works, his first labours being various alterations and additions at Windsor Castle, at the suggestion of King George III. In the office of Mr. James Wyatt, his nephew served a second term of apprenticeship; and, besides improvement in practice, thus obtained numerous introductions to influential persons, among whom was the Prince of Wales, who honoured him with personal notice up to 1799. In this year, Mr. Jeffry Wyatt joined in business an eminent builder, who had extensive government and other contracts. In this profitable concern he continued till 1824: when, after an absence of twenty-five years from Royal intercourse, he unexpectedly received from King George IV. instructions respecting designs for the restoration of Windsor Castle.

The union of the tradesman with the architect was deemed, by the Royal Academicians, a sufficient bar to the advancement of Mr. Jeffry Wyatt to be one of their society; and he was allowed to continue as a candidate for twenty years, before he was admitted a member. During this period, he made many designs for public and private buildings, which were erected in different parts of the kingdom, some of which manifested architectural talents of a high order. He was, at length, elected an associate, and speedily afterwards, one of the Royal Academicians. Among various designs which he had exhibited at that nursery of the arts, was one called "Priam's Palace," which attracted much admiration during the exhibition. This, and his other architectural drawings, and executed buildings, are ample evidences of his love of, and devotion to, his profession.

One of the first acts of the new Parliament, after the accession of George IV., was the projection of great alterations and improvements in the magnificent castle-palace at Windsor. For this purpose, it was agreed that the three attached architects to the Board of Works, Messrs. Soane, Nash, and Smirke, with Mr. Jeffry Wyatt, should be directed to make plans, drawings, and estimates. The sum of £300,000 had been voted by Parliament towards the expenses of these improvements, and a commission of eight noblemen and gentlemen, members of the administration and of the opposition, were appointed to advise as to the works and expenditure of the money. Among these "Commissioners" were the Earl of Aberdeen, President of the Society of Antiquaries, and Sir Charles Long, (subsequently Lord Farnborough,) a distinguished Fellow of that enlightened institution: both men of refined taste in the higher departments of art. In May, 1824, the respective architects above named (with the exception of Mr. Soane,) submitted their drawings to the Commissioners, when the designs of Mr. Jeffry Wyatt were approved of, and accepted. The Commissioners next visited Windsor; the plan of operations was settled, and, on the 12th of August, 1824, the birthday of George IV., the first stone was laid by the King, it being part of the foundation of the new gateway on the southern side of the Great Quadrangle, and thenceforth named George the Fourth's Gateway. On this occasion, the architect received the royal authority for changing his name to Wyattville; not merely as a personal compliment, but for the purpose of distinguishing and separating the Wyatt of that reign from his uncle, Mr. James Wyatt, whose share in the architectural works at Windsor, during the reign of George III., has already been mentioned. Furthermore, George IV. suggested and conferred the additional armorial quartering to the architect's family arms, of a view of George the Fourth's Gateway, with the word *Windsor*, as a motto.

Without the aid of plans and views of the buildings, it is impossible to convey to the reader any clear idea of Windsor Castle at the time that Mr. Wyatville commenced his improvements, in 1824, and at the period of their recent completion. It may be sufficient to mention, that the alterations and additions made in the Castle buildings, from the commencement of the Tudor dynasty to the year 1824, were not only inharmonious with the castellated character of the older works, but were generally tasteless in design, and slight and bad in execution. Hence the whole of the latter class were taken down, when the whole of the main timbers were found to be decayed. New floors and ceilings, with new partition walls, were necessary; and to improve the exterior effect of the elevations, each wall was raised several feet, and finished with bold embattled parapets. The angular and intermediate towers were also augmented in height, and each crowned with a machicolated summit. The chimney-shafts were formed into stone clusters, and made to assume the shapes of turrets. Around the south and east sides of the interior of the great quadrangle, was erected a spacious corridor, 550 feet in length, connected with and forming grand and convenient approaches to the chief suites of apartments which belong to those parts of the Castle.

The works proceeded with such rapidity, (the architect devoting the whole of his time to the vast undertaking,) that, on the 9th of December, 1828, the King's private apartments were completed, and his Majesty removed from his rural retreat, a superbly embellished cottage in the Great Park, and formally took possession of the Castle. The next public act of the King was to confer the honour of knighthood on his architect, who, also, was permitted to take up his residence in a commanding tower, in the middle ward, at the west end of the north terrace.

The progress of the repairs was rather expedited than stayed by the King having taken up his residence at the Castle. The decayed and dangerous state of the building had, however, occasioned an expenditure much beyond the original estimates; indeed, at Midsummer, 1830, the cost appeared to have been nearly doubled.

Application was, accordingly, made to Parliament for further advances; when, opposition being raised in the House of Commons, a committee was appointed to investigate the Castle works, and the probable amount of money requisite for their completion. The committee, at length, ordered works to be undertaken to the estimated amount of £148,796, to be advanced at the rate of £50,000 per annum. This grant was made exclusively for the architect's department, independent of the upholsterer, decorator, and other artisans. Since that time, much has been done. The Elizabethan Gallery has been finished, and fitted up as a library; the Waterloo Gallery has been completed, and adorned with portraits, by Lawrence, of the principal monarchs, statesmen, and generals of Europe; the old principal staircase has been removed, so as to present an uninterrupted view from the northern terrace, *through the superb pile* by means of opposite entrances, to the unrivalled Long Walk on the south; a noble staircase having been elsewhere constructed, in which is placed a colossal statue of George IV., nine feet, six inches high, by Chantrey. Lodges have also been erected at the junction of the Long Walk with the Home Park; and several of the old state apartments, at the north-west part of the upper court, have been enlarged and substantially repaired. At the north-west angle of this court, Sir Jeffry had designed a splendid chapel. The heightening of the Keep, or Round Tower, by some feet, is also an improvement which adds pre-eminently to the dignity of the magnificent pile.

It has been well observed, "so completely has Sir Jeffry made the Castle his own, that nobody else can distinguish between what belongs to himself and his predecessors." The style of the building is old, while the material is new; and the harmony of parts is so complete as to form a whole of almost inexpressible massiveness and grandeur.

Von Raumer, on his visit in 1833, found Windsor far exceeding his expectations, and making a greater impression on him than all the other castles he had ever seen, put together. "This is high praise," says the Literary World, "from a native of Germany, where feudalism has left so many stately monuments of its frowning glory.

Hitherto, there has been published no fitting record of this grand national repair of the proudest structure that England possesses. King George IV., with the intention of consummating the truly regal labour, and, in strict princely state, commanded Sir Jeffry Wyatville to publish an account of his great work; the missive, in the handwriting of the sovereign, is in the possession of Sir Jeffry's executors, as is also a confirmation of the command, from Queen Victoria. Sir Jeffry had made much progress in his task; he having expended £3000 upon drawings.* In the Picturesque Annual, the author relates, that George IV. promised to send a copy of Sir Jeffry's work to every sovereign in Europe; but, with the exception of this patronage, Sir Jeffry, it is believed, although working at the Royal command, did not expect assistance of any kind. On one occasion, when surprise was expressed at such a condition, Sir Jeffry replied, in the spirit and pride of art; "The task is MINE; I am preparing my own monument."

Notwithstanding that Windsor Castle is the *chef d'œuvre* of Sir Jeffry Wyatville, and, for ages to come, will stand as the best record of his skilful taste, he had wholly built, or improved, many other edifices in different parts of the kingdom. He has left some of his works in thirty-five, out of the forty, English counties, and four, out of the twelve, Welsh. From a list of above 100 of these buildings, the following, with the names of their owners, are appended to the memoir already quoted:—

Badminton House, Gloucestershire, Duke of Beaufort.—Drawing-room and library.

Woburn Abbey, Bedfordshire, Duke of Bedford.—Temple of the Graces.

At Endsleigh, Devonshire, Duke of Bedford.—A spacious and commodious seat, in the cottage style.

Chatsworth House, Derbyshire, Duke of Devonshire. Some magnificent new buildings, also alterations and restorations of the old mansion, in the Italian style. These have just been completed.

Longleat House, Wiltshire, Marquis of Bath.—New conservatory, stables, offices, staircase, and alterations of the hall, &c.

Ashridge, Hertfordshire, Earl of Bridgewater.—The completion of the house, begun by James Wyatt, R.A.; the Bridgewater column in the park, and lodges.

Bretbey, Derbyshire, Earl of Chesterfield.—Parts of the house.

Gopsall, Staffordshire, Earl Howe.—A new lodge, &c.

Belton House, Lincolnshire, Earl Brownlow.—New green-house, and alterations to the mansion.

Wollaton Hall, Nottinghamshire, the Lord Middleton.—Alterations to the interior, and new lodges to that fine Italian house.

Sidney College, Cambridge.—New gate-house, and fronts to the whole college.

Besides the above, which are generally called show places, Sir Jeffry has designed and executed the following *new houses*:

Lilleshall, Shropshire, Earl Gower.
Golden Grove, Caermarthenshire, Earl of Cawdor.
Nonsuch Park, Surrey, Samuel Farmer, Esq.
Dinton, Wiltshire, William Windham, Esq.
Denford, Berkshire, William Hallett, Esq.
Stubton, Lincolnshire, Sir Robert Heron, Bart.
Hillfield Lodge, Herefordshire, The Honourable G. Villiers.
Trebursye, Cornwall, The Honourable William Elliot.
Banner Cross, Yorkshire, General Murray.
Wimborn, Dorsetshire, William Castleman, Esq.
Claverton, Somersetshire, John Vivian, Esq.
Hastings, Sussex, Compt de Vandes, &c. &c.

By the introduction of Queen Adelaide, Sir Jeffry designed a castle for Altenstein, for her brother the reigning Duke of Saxe Meiningen; as also a palace, with extensive stables, and a riding house for Meiningen; for which works the Duke presented him the grand cross of the Saxon Ernestine order, as a mark of his approbation. In the summer of last year he designed the stables at Windsor Castle. This design, though of almost quaker like plainness, evinces the same strong faculty for arrangement under difficult circumstances, which characterized all his former works. As late as November last, he designed lodges for the Sheffield and Derby entrances to Chatsworth: the latter of which is full of boldness and originality, and as vigorous as any design he ever produced, although his last work, except an Alcove for the gardens, which is as playful as the work of a young hand.

---

* Mr. Weale has received instructions to publish this splendid work forthwith.

Sir Jeffry Wyatville was proud of the Royal patronage which he enjoyed; and the Sovereign was alike proud of his favorite architect. As a compliment. a portrait of him was painted by Sir Thomas Lawrence, by command of George IV., and was placed in the royal collection at Windsor Castle. It is considered to be, altogether, an impressive likeness: there is extraordinary quickness in the eye, and the forehead is lofty, but wants breadth, such as indicates superior intellect. We believe Sir Jeffry to have been in no degree indebted for his success to sycophancy; for, although "of the court" he was not over courteous in manner. His roughness, however, enabled him to conquer the caprice of his royal patron. It is related in the *Athenæum*, that "when the Kings private apartments were under consideration, his Majesty was naturally somewhat more peremptory than usual, especially as to their relative proportions, and it is well known that he did not like large rooms. Wyatt's head, however, was full of a palace; and when the king suggested what he considered a proper size for his dressing room, Wyatt protested that such a cupboard was better suited to a country curate than to his Majesty. The latter, however, was peremptory on the subject, and cut short all remonstrance with—"It shall be so." The works went on—the suite of apartments was finished and furnished, when, in the exultation of the moment, his Majesty good-humouredly reminded the architect of their former difference, and triumphantly referred to the admirable adaptation of this particular chamber. 'I am glad your Majesty approves of it,' said the architect, 'for it is exactly twice the size your Majesty directed."

He languished for the last five years, under a disease of the chest, which has visited him with voilent attacks from time to time; and frequently endangered his life. Still his mind never gave way, or was weakened by illness. He possessed the same good sense, industry, and indefatigable order in his art during his last illness, as at any former period of his career—which was marked by simplicity and integrity, as was his death by perfect cheerfulness and resignation. His last days were a dignified lesson to the old, as his well spent life had been a model of usefulness to the young. He died on the 18th of February, in his 74th year.

The remains of Sir Jeffry Wyatville were interred in St. George's Chapel, Windsor, on the 25th ult.; the body having arrived at the Winchester or Wyatville Tower, on the preceding evening. The Rev. Dr, Goodall, Provost of Eton, an old and valued friend of the deceased, read the burial service; and the coffin was deposited in a vault in the east aisle of the Chapel, just behind the altar; which Sir Jeffry had prepared some years since, for the reception of the remains of his daughter, who, it is stated, died in consequence of a cold, taken during her attendance at the ceremony of laying the foundation stone of the Brunswick Tower. Among the mourners was Sir Francis Chantrey, the sculptor. And thus, within the shadow of the stately pile which his genius had restored from crumbling decay, sleeps the architect himself; thus exemplifying the adage: "Art is long, and life is but short."

NOTES OF THE MONTH.

The Oxford Society for the Study of Gothic Architecture is making progress, its library is increasing, and the papers read at its meetings have been valuable and interesting. It is to the clergy that we must look for the preservation of old edifices, and for the observance of good taste in the erection of new ones.

Mr. Cockerell has been selected to erect the new Institute at Oxford, founded by the late Michael Angelo Taylor.

The second of this month is the day on which the tenders are to be sent in for construction of the Nelson Memorial. The shaft is to be solid, of granite from the West of England, and the capital of bronze.

Messrs. Grissell and Peto have commenced operations for raising the superstructure of the New Houses of Parliament.

The Royal Exchange affair is still in statu quo, except that as far as report goes Mr. Cockerell and Mr. Tite are engaged in making fresh plans. We doubt much whether they will be able to produce a better design than that of Mr. Donaldson, which we had another opportunity of viewing, when it was exhibited at the Royal Institute of British Architects. If, as Mr. Smith reported, at maximum prices it only exceeded the sum allotted by £9000, it ought to be adopted. As to the paltry objection that there were no chimneys, any man with brains in his head might have seen that they could have been introduced in any part of the walls which surround the room, the thickness of which was ample for flues, but the system of warming public offices by hot water or steam is so general that it could hardly be thought necessary to provide fire-places. Then again as to the statement that many walls had false bearings, even if such had been the case, this might easily have been remedied without in any way interfering with the external design, which is the grand feature to be considered. As to the last objection, that there were not sufficient shops, it is too contemptible to require notice.

Another competition exhibition takes place this month, that on the 8th for laying out the grounds of the Royal Botanic Society. We hear that many designs of merit are in preparation, and we sincerely trust that the Council will allow a public day for the profession to witness an exhibition, which we believe has never before taken place in the metropolis.

On the first (anomalous day!) the Soane Museum opens to the public! When will this Museum and Library of Architecture be made what it ought to be?

The Institute of Architects of Ireland has received the Royal patronage, and we sincerely trust that the institution will be worthy of a capital possessing so many fine buildings.

A new shop in the style of the Revival is now attracting attention in Regent-street, being the first in this fashionable style.

Some Elizabethan pumps a little above the common run have been erected in Holborn and its vicinity.

The wood pavement in the Strand is on Parkin's plan.

Iron statues are in great vogue at Paris as accessories for architectural purposes.

The embankment of the Thames is at last likely to be taken up by government and city authorities.

We feel great pleasure in announcing that a want severely felt by artists, that of a gallery of casts is at last to be remedied, not by government, but by private enterprise. A similar plan was stopped last year in expectation of the government doing something, but it was so absurd that it was fortunate it was abandoned, being neither more nor less than to interfere with private enterprise, by manufacturing all kinds of casts. A worthy companion to the steam boat plan! Mr. Braham, with great public spirit, has opened the Model Gallery at the Colosseum as a place for study at the trifling subscription of one guinea per annum. It is well lighted, and contains above a hundred works, including the Tragic Muse (12 feet high), Apollo, Townley Venus, head of Achilles, Moses of Michael Angelo, &c.

There is an intention on the part of government to make a grant to the Schools of Design. This would be a boon to the manufacturing interests and the fine arts generally.

A statue to Napier, the inventor of logarithms is in agitation at Edinburgh.

At the Institute of Civil Engineers Mr. Nasmyth exhibited his pneumatic mirror, which is a plate of glass 3 feet in diameter, on a concave disc of iron hermetically sealed. On exhausting the air the plate collapses, and on its being forced in the plate rises so as produce any form of speculum. Mr. Nasmyth suggests its application to astronomical purposes for large reflecting telescopes, or it may be used as a burning glass.

Mr. Whishaw the engineer kindly exhibited to us a valuable chronometer which he has used in preparing for his elaborate work on Railway Statistics, for ascertaining the velocities of railway trains. It is 3 inches in diameter, and consequently of a circumference of near 9½ inches, which is a scale of one minute decimally divided into hundredths, so as to enable nice calculations to be made with accuracy.

In the valuable paper of Mr. Leeds in our present number, we took the trouble to note down the length of life of 142 architects enumerated, and found one-third between 65 and 75, of which 27 between 70 and 74, and 22 between 75 and 80. A pretty good proof of the longevity of this class of professional men.

We have not had the opportunity of mentioning before the completion of the lighthouse on the sands at Fleetwood on Wyre. This is constructed by Mr. Mitchell with his patent mooring screws, on a similar principle to that on the Maplin sands described in the Journal. It is of an hexagonal form, six mooring screws supporting the base with one in the centre thus,

```
  o o
 o o o
  o o
```

These carry converging posts on which the platform is erected, which carries the lighthouse, so that it is open below to the action of the sea. This work, in an incomplete state, stood out the late severe gales, and does great credit to its constructor, and to the spirit of Sir Hesketh Fleetwood.

A BILINGUAL STONE.

A bilingual inscription, containing Latin, Umbrian, or Etruscan words sculptured on both sides of a Tiburtine stone, was found some months ago near the ancient ruins called Mausoleo. At first it was believed to be apocraphal; but on being brought to Rome and examined, all doubts with regard to its authenticity were removed. From the Latin words *Frater eivs minimus*, which occur in the beginning, it was hoped that something of interest might be deduced. The rest of the inscription can only give room for conjecture, the letters running from left to right, as is evident from the expressions, *Locavit et statuit*, which in themselves contribute in no way to elucidate the obscurity of the Epigraph, and it is well known that the national paliography whether Umbrian or Etruscan should run from right to left. This stone was in all probability a terminal *Cippius*, referring to the period when the Romans made Etrusia a subjected province, as yet, however, the true and precise signification is obscure, first on account of its bilinguous form, and also for the uncertainty of the letter X: which is known to be a T in Umbrian or Etruscan. Another ambiguity arises from not knowing the true pronunciation of K and ⊳⊲. This however must be left to the consideration of the learned, and for whose better judgment we subjoin the following copy of the epigraph.

The best preserved side.	The most defaced.
....	....
S	....
DRVTEI. F. FRATER	...... V. EIVICIVIV
EIVS	......NISIS. DRVTI. F
MINIMVS. LOCAVIT	...... RATER. EIVS
ET. STAVIT.	..MINIMVS. LOCAVIT. E.
EX. EICNFXI. XIↃVX	........ATVIT QVI.
IICNI. ICFIↃNIXV	....ERNFXI. XOVXI. I.
FOXVF⊳⊲KCNSIS. X·	.... NIXV. LOKFN. KO
DVXIKNCIS.	..........XIKNOS.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

INSTITUTION OF CIVIL ENGINEERS.

SESSION, 1840.

Jan. 14. JOSHUA FIELD, V.P., in the Chair.

"*Observations on the efficiency or gross power of Steam exerted on the piston in relation to the reported duty of Steam Engines in Cornwall, at different periods.* By JOHN SCOTT ENYS, Assoc. Inst. C. E.

The advantages which may result from the union of scientific and practical knowledge in the application of steam power, particularly with reference to the limits of gross power, are great, as likely to check the extravagant notions entertained by some with respect to the farther increase of duty, and to remove the disbelief of others with respect to the amount of duty actually performed.

The limit of duty for atmospheric steam may be readily arrived at, as was done by Mr. Davies Gilbert in 1827, by estimating the weight of water which would rise 34 feet into a vacuum formed by the condensation of steam of atmospheric strength; whence it appears, that a higher duty than 30 millions cannot be obtained by atmospheric steam, 14 cubic feet of water being evaporated by a bushel of coal. Tredgold, in the first edition of his Treatise on the Steam Engine, published in 1827, adopted the simpler method of multiplying the volume of steam of atmospheric strength by the pressure, for the measure of the efficiency. This principle may be extended to measure the efficiency of steam at higher pressures, as the author has shown in the first annual report of the Cornwall Polytechnic Society; and an extended table to ten atmospheres is appended to this communication.

The author then proceeds to show, that the Cornish engines are worked under conditions such that a large proportion of the expansive action of the steam is available on the piston, and calls attention to two necessary corrections—1st, for the deficiency of water in high steam cut off at $\frac{1}{5}$th of the stroke; and 2d, for the increase of temperature of the steam during expansion in the cylinder, as derived from the steam jacket. The experiments of Mr. Wicksteed, confirmatory as they are of the very extended experiments made by Woolf at Wheal Alford, show the importance of this latter correction. Some error has also arisen from the use of the boiler pressure. The exact determination of the pressure in the cylinder is difficult, and the only recorded experiments are those by Mr. Henwood with the common indicator, and published in the second volume of the Transactions of the Institution. The indicator is liable to show a pressure higher than that actually exerted during the expansion, but it may be relied on for comparative results; and very accurate experiments made at the Consols by a mercury gauge, the engine being stopped at differents parts of the stroke, are said to confirm the reliance which may be placed on the indicator.

The quantity of water evaporated was very imperfectly recorded; it was stated by Watt as from 8 to 12 cubic feet per bushel, and at present may be stated at about 14 cubic feet, but is sometimes, with good coal and careful stoking, much higher.

The author briefly alludes to the progress of improvement in Cornwall; the introduction by Woolf of high steam; the substitution of the plunger pole for the bucket pump, and the application, so recently made by Mr. James Sims, to stamping or crank engines of the arrangements which had been a long time so advantageously in use in pumping engines.

The communication is accompanied by a table, exhibiting the weight of water per cubic foot; the pressure; the volume and the efficiency of steam from one to ten atmospheres, adapted and corrected from those of Clement and Desormes. It is also accompanied by a method of representing several particulars connected with the load and engine; by which the relation of these with respect to each other in the same engine, and the different conditions of other engines, may be at once exhibited to the eye. It may also prove a convenient method of recording facts and calculations in connexion with the Indicator Diagrams.

"*Analysis of a piece of the iron heel post converted by the action of Sea Water into a substance resembling Plumbago.*" By DAVID MUSHET, A. Inst. C. E.

A piece of the iron heel post of a vessel called the John Bull had been presented last Session by Mr. Borthwick, as a curious specimen of the effect of salt water in converting iron into a substance resembling plumbago. This substance was of a dark brown colour, and easily cut by a knife, and Mr. Mushet undertook to analyse it; and the result of this analysis, and the methods pursued, are the subject of this communication. This substance, which it may be convenient to call marine plumbago, on being exposed to a red heat in a crucible, lost about 20 per cent. in weight, and on being exposed to a white heat for four hours lost about 60 per cent., and came out a light mass of very brilliant carburet. This shining carburet was then used as a carbonaceous substance for the reduction of an oxyde of iron, but was less efficacious than the same quantity of the charcoal of wood. From these and other experiments, Mr. Mushet considers 100 parts of the so-called marine plumbago to be composed near as follows:—

Carbonic acid and moisture	20
Protoxyde of iron	35·7
Silt, or earthy matter	7·2
Carbon	41·1

Also, he considers 100 parts of the common black lead to consist as follows:

Carbonic acid and water	12·5
Iron	11·5
Earthy matter	4·5
Carbon	71·3

"*A theoretical calculation of the Fuel saved by working Steam expansively.*" By J. W. LUBBOCK, Hon. M. Inst. C. E. &c. &c.

An equation may be readily formed for the action till the steam is cut off; and the steam being then supposed to dilate into a certain volume, the variation in this volume gives rise to the quantity of action, whence another equation may be obtained, and the maximum of the quantity of action produced by cutting off the steam determined. The quantity of action thus produced is then compared with that produced in any case without cutting off the steam. Now the quantity of heat or fuel expended is proportional to the steam generated in each of the preceding cases, and a proportion, expressing the ratio of the fuel saved to the fuel expended, may be obtained.

"*On the Expansion of Arches.*" By GEORGE RENNIE, F.R.S.

The expansion of solids, which has excited the attention of mathematicians since the investigation of La Hire, in 1688, on a rod of iron, is of particular importance in the construction of bridges, the security of which may be effected by the dilatation and contraction consequent on changes of temperature. Periodical motions, referable only to changes of temperature, were observed by Vicat in a stone bridge built over the Dordogne at Souillac, and have frequently been noticed in structures of all kinds. The different expansibility of stone and iron has been considered an objection to the use of cast iron pillars in connexion with stone to support the fronts of buildings; but the experiments of Mr. Adie of Edinburgh led him to the conclusion, that no danger is to be apprehended from a change of temperature affecting cast iron and sandstone in any great degree, as their expansion, so far as regards buildings, may be considered the same.

Arguments from this source were employed against the arches of Southwark Bridge, and the experiments set forth in this communication were undertaken with a view of ascertaining the effect of temperature on these arches.

Three sets of experiments were made: the first in Jan. 1818, when the main ribs and diagonal braces rested on their centres, and before any of the spandrils and road plates had been put upon them; the second, in the August and September of the same year. The rise was measured by the insertion of small wedges to about $\frac{1}{40}$th of an inch. The third set of experiments was made on the eastern arch. Three thermometers were employed—one hanging in the open air, another having the bulb immersed $1\frac{1}{2}$ inch in the iron, and the third hanging amongst the ribs; these were observed at different hours of the day, and the results recorded. The rise of the arch was observed by a fine piece of feathered edged brass, nicely fixed to the rib, which by the rise and fall of the arch traversed upon a scale graduated to $\frac{1}{80}$th of an inch. The tables contain experiments on nine days, with the temperatures and rise at every hour of the day. The results, that is, the maximum temperatures and rise, and rise for 1° Fahr. are exhibited in the following table.

No. of Experiment.	Variation in Temperature.	Rise in Arch.	Rise for 1° F.
I.	15°	$\frac{25}{80}$	$\frac{1}{48}$
II.	10°	$\frac{16}{80}$	$\frac{1}{50}$
III.	7·5	$\frac{13}{80}$	$\frac{1}{47}$
IV.	11°	$\frac{22}{80}$	$\frac{1}{40}$
V,	6°	$\frac{13}{80}$	$\frac{1}{37}$
VI.	4·5	$\frac{10}{80}$	$\frac{1}{36}$
VII.	3°	$\frac{9}{80}$	$\frac{1}{26}$
VIII.	8°	$\frac{14}{80}$	$\frac{1}{45}$
IX.	7·5	$\frac{21}{80}$	$\frac{1}{28}$

The mean rise is $\frac{1}{40}$th of an inch for 1° Fahr.

Mr. Rennie then proceeds to calculate the theoretical rise from the expansion of iron, according to Lavoisier, in an arch of the dimensions of Southwark Bridge, for 50° increase of temperature.

The effects of changes of temperature were also observed in the stone bridge over the Thames at Staines. After the arches had attained their full settlement, openings were observed in the joints of the parapets immediately over the springing of the arches, and a distortion or sinking of the upper curve of the parapets. A wedge was inserted into some of these openings, and the lowest point of its descent in the month of January marked. The same wedges were carefully inserted every week until May, when they would no longer enter, and the joints became firmly closed. At this period, however, the joints immediately over the crowns of the arches, which had during the winter been quite close, were now open. From these facts it followed, as a necessary consequence, that in winter the arch contracting descended and the spandril joints opened, and in summer the arch expanding rose and closed these joints, and opened those at the crowns. Thus the joints of the parapets, which were made of single slabs of granite for the whole height, became good indicators of the changes of temperature. It had also been observed, in the Waterloo and other bridges, that joints made good in the winter with Roman cement were found crushed in summer.

With the view of obtaining some data for calculation, Mr. Rennie procured samples of granite, sandstone, and slate, and placing them in a properly constructed oven, ascertained the rates of their expansion, which are given in the paper.

A series of experiments was made at the request of the late Mr. Rennie by Mr. S. Walker, of Rotherham, on the variations in the length of 231½ feet of the frieze, bolted together and laid on a firm platform. The temperature of the atmosphere and of the plates and the length were noted at five o'clock in the morning and at three o'clock in the afternoon, and in some of the experiments at seven o'clock in the evening. The details of these experiments are given in the paper.

The paper is accompanied by calculations for the rise of an arch and the opening at the spandrils for an increased temperature, and also by tables of the expansibility of different kinds of stones and irons given by Distigny.

"*Specification and Working Drawings of the Middlesborough-on-Tees Gas Works.*" By PETER HENDERSON, Assoc. Inst. C. E.

In this communication, the author details the several works, erections, and fittings of the Gas Works at Middlesborough-on-Tees, and the mode in which they are to be executed and completed.

"*On a mode of Dowelling Timber, or of combining it and other materials for general purposes.*" By M. J. BRUNEL, M. Inst. C. E.

The author proposes to unite timber by means of iron dowels and asphalte. Mastic had been used in the Tunnel works for the purpose of fitting small plates of cast iron to the poling boards. These, though constantly immersed in water and mud, and subject to severe hammering, had stood perfectly well. Asphalte is now used in preference to mastic, as it sets immediately. The author conceives that stone may be united by a similar kind of dowelling; and that wood may be interposed between stone and iron, so as to be used to advantage with the stone blocks, for the chairs of railways. Also, that this method may be used with great advantage in ship-building, in mast-making, and wherever any species of dowelling is required.

Feb. 21. The PRESIDENT in the Chair.

"*On Steam Engines, principally with reference to their consumption of Steam and Fuel.*" By JOSIAH PARKES, M. Inst. C. E.

The above is the second and concluding communication on this subject; in the former, the generation of steam more particularly was considered; in the present, its application when generated. These are distinct questions, as it is the economy of steam which constitutes the dynamic perfection of a steam engine, whereas it is the economy of heat in supplying that steam which constitutes the perfection of the boiler as an evaporative vessel. These economic properties are totally independent of each other; they may co-exist in a maximum degree, or in very different degrees, and the degree of perfection which any particular class of engines, or which the particular engines of any class possess, is known from the weight of fuel burnt, of water evaporated, and the mechanical effect realized. As long as engines were constructed with but few varieties, or identical in their forms, the performance of one was a sufficient indication of the performance of all; but new forms of engines and new modes of practice being now introduced, a comparison of the performance on the several systems is a matter of deep practical and scientific interest. With the view of effecting this object, the author has collected all the authentic facts within his reach, and reduced them to common standards of comparison.

The effective power of steam engines may be ascertained either from the resistance overcome, or from the load upon the piston by means of the indicator; the former method being applicable to pumping, the latter to rotative engines. But the effective power of the steam in pumping engines, as thus ascertained, is far below the real effective power of the steam, and no exact comparison can be made by these means between the effective power of the steam in the two classes of engines. The useful effect is not synonymous with a true measure of effective power, since the duty is the true useful effect in a Cornish engine. The indicator when applied to the Cornish engines enables us to ascertain the absolute but not the effective power, so as to compare it with that of the rotative engine, since the friction of the engine and the load cannot be separately determined. The absolute power of the steam may also be ascertained from the relative knowledge of the elastic force of steam corresponding with the ratio which the volumes of water bear to each other. This theoretical estimate requires however several corrections; among which the steam condensed by contact with colder surfaces, the steam consumed in filling useless places, and that lost by priming, must be particularly noted.

The relative performance of pumping engines is well expressed by the term "duty," that is, the number of lbs. raised one foot by a given quantity of fuel; and of rotative engines by the term "horse power," that is, the number of lbs. raised one foot in a minute, divided by 33,000 lbs. the standard measure of a horse. The performance of the rotative engine may also be estimated by duty, and of pumping engines by horse power. The results of these computations for several engines are tabulated in this communication.

The sum of the latent and sensible heat being constant for steam of all elasticities, the expenditure of both power and heat is truly measured by the weight of water consumed as steam; this measure is free from all uncertainty, and independent of all theory; the weight of water as steam equivalent to the production of a horse power in each engine, and the duty effected by one pound of steam, will denote the positive and relative efficiency of the steam and the heat. These indices of efficiency being referred to some standard, we learn, from the preceding data, the precise value of each engine in its use of steam and fuel; of its boiling apparatus, as a generator of steam; of the comparative efficiency of the steam and coal, or economy of power and fuel. The results which may thus be obtained are also exhibited in tables, accompanying the communication.

The power resulting from the expenditure of equal weights of water, as steam, being known, the boiler may be connected with the engines, and the relative extent of heating surface employed to furnish their power shown. It will thus appear that equal measures of surface are quite inadequate to supply equal power, with equal economy, to different classes of engines. These results are tabulated in great detail, and it appears that the Cornish engineers now employ nearly eight times as much boiler surface for equal nominal power as that given by Watt's practice. But taking into account the fuel burnt per horse power per hour in the two cases—the Cornish engine consuming 2½ lbs. per horse power per hour, and Watt's engine 8½—the true relation of the boilers is as 19 to 1. Many other relations of a similar striking character may be deduced from these tables.

The detailed results of the experiments by Smeaton in 1772, on his improved Newcomen engine at Long Benton—by Watt, in 1786, on his rotative condensing engine, at the Albion Mills, are recorded in these tables; and it appears that the economy of the latter as regards steam and fuel was double that of the former, and approached very nearly to perfection in the use of power obtainable on that principle. The next great advance in the economy of fuel and power is that made by the Cornish engineers, whose performances, both with pumping and rotative expansive engines, far exceed any attained with the common unexpansive condensing engine. The superiority of two of these engines in 1835, doing a duty of 80 millions, exceeds the engines of Watt and Newcomen by 2½ and 5 times in economy of power, and by 3½ and 7 times in economy of fuel.

The obtaining a standard measure of duty is of great importance; a heaped measure, as a bushel of coals, is highly objectionable, as the weight of such measure will vary from 84 to 112 lbs. In the Cornish reports the bushel is fixed at 94 lbs. weight, as the standard of comparison, but some portion of a ton or one lb. would be a better standard. Other combustibles, however, as coke, peat, &c., may be used partially, or to the exclusion of coal, and under these circumstances some other standard of comparison is necessary, and with this view the author suggests a pound of water in the form of steam as the best standard of duty. The work done by a given quantity of water as steam is a sure index of the quality of the steam engine; it is a measure uneffected by variable calorific agents, and so long as engines continue to be worked by steam, so long will the performance of different engines be accurately gauged by their respective expenditure of water as steam. The accuracy of this measure depends on the physical fact of the constancy of the latent and sensible heat in steam of all temperatures. The author has recorded twenty-eight experiments made on twenty-eight different days, on vaporization from the boiling point to 60 lbs. pressure above the atmosphere, which present a remarkable confirmation of the above law, and show that the relative efficiency of steam in engines is due to the manner of using it, and not to any change in its chemical constitution at different pressures. The manner of conducting these experiments, and the precautions taken to ensure accurate results, are detailed with great minuteness.

The author next proceeds to treat of the Locomotive Engine, and to discuss, compare and tabulate the facts relating to this engine in the same manner as he has done those of the stationary class. The qualities of the boiler of the locomotive as an evaporative vessel had been discussed in the first communication. The locomotive differs from the fixed non-condensing engine only in the use of the blast, and the same method of measuring the effects of the steam are applicable to both. Experimenters on the locomotive have generally attempted to determine the amount of resistance opposed to its progress in preference to ascertaining the power expended in overcoming the resistance. The exact solution of either of these questions would furnish all that is wanted; but the ascertaining the total resistance by an analysis of its several constituents is attended with great difficulties, as the forces to which they are to be referred are so exceedingly numerous and variable, that the assigning the exact value to each at any one velocity has hitherto eluded the talents of those who have pursued this method. M. de Pambour was the first analyst whose labours will require attention. The results given by this author in his practical treatise on Locomotive Engines on Railways were compared by Mr. Parkes with the results which he had obtained when experimenting on an engine of precisely a similar character, and discrepancies presented themselves which appeared totally irreconcilable. These and other circumstances led the author to consider, whether the resistance to traction would properly be deduced from the laws of gravitation, or whether any certain results would be derived as to the amount of resistance on a level from observations on engines and trains moving down inclined planes. The great object seemed to be to discover some criterion of the mechanical effect produced by a locomotive at all velocities, which would apply as practically and as distinctly to a locomotive as duty to a pumping engine, or horse power to a rotatory engine. If this were possible, it seems of far less importance to distinguish the precise value of each particular unit of resistance, than to determine the relative sum of resistance and the relative expenditure of power at all velocities and under all circumstances. Now the term duty may be applied in the strictest sense of the term to the work done by a locomotive engine; for whether the engine drag a load whose resistance is 8 lbs. per ton, or whether a weight of 8 lbs. for each ton of matter moved descending over a pulley and attached to the load, be considered as the moving force, the result is the same. If, then, the tractive force, or resistance per ton of matter in motion, which is the real load on the engine, be ascertained, the whole effect is found by multiplying this sum by the space passed over in feet; and the consumption of water as steam and of coke being known, we have all the elements requisite for determining the duty performed by the steam or coke. The pressure against the pistons may be deduced from the sum of the resistances first calculated on the assumed resistance overcome at the velocity of the engine in each experiment; and the pressure on the pistons may also be deduced from the ratio of the volumes of the steam and water consumed. The results which may be obtained on these principles are tabulated, for the experiments of M. de Pambour, Robert Stephenson, and Dr. Lardner. In another table the author has recorded the reduction of each of these experiments to terms of horses' power, and has exhibited under that denomination the absolute power resulting from the steam used—that required to overcome the assigned resistance—their differences—and the power which balances the gross and useful duty. The construction of these most elaborate tables is described in great detail, and the consequences which follow from the tests thus obtained are fully stated, and the author comes to the conclusion, that results inconsistent with the capabilities of the locomotive are perceptible in almost every one of the experiments. A condensing engine placed on wheels, with water of condensation transported for its supply, and made to drag a train along a railway, would require the same expenditure of water as steam, to produce a given effect, as if fixed; a non-condensing engine also is one and the same machine, whether fixed or locomotive, excepting that the latter must consume more power than the former, to do equal work, at like pressures, by the amount of the additional resistance arising from the contraction of its eduction pipes, in order to produce a fierce blast of steam through the chimney. From these and other causes the fixed non-condensing engine must be the more economical of the two; but if the results derived from M. de Pambour's data be correct, we must acknowledge the fixed non-condensing engine, with its simple atmospheric resistance, to be far inferior in economy of steam to the locomotive, with its plus atmospheric resistance. The experiments by Dr. Lardner were made for the purpose of determining the resistance opposed to progressive motion on railways. They consisted in dismissing trains at various speeds from the summit of inclined planes, and in observing their velocity when it became uniform, the resistance at such velocity being equal to the accelerating force of gravity down the inclined plane. The results of these are tabulated in the same manner as the preceding, and the most singular discrepancies present themselves. For instance, it would appear that in one particular case a duty of double the amount of that effected by the condensing engine was performed by an equal expenditure of power; that compared with a fixed non-condensing engine at equal pressure, the locomotive, though labouring against the heavy counter-pressure of the blast from which the other is free, is assumed to have performed equal work with less than one-half the expenditure of power. That if the resistance assigned by Dr. Lardner as opposed to the progressive motion of the train be correct, the efficiency of the steam in the locomotive is more than double that obtained by the best condensing engines; more than treble that derived from stationary non-condensing engines, and equal to the performance of a Cornish expansive engine, doing a 50 million duty with a bushel of coals. With such results before us, the resistances assigned as opposed to and overcome by the locomotive at different velocities, must be regarded as utterly inconsistent with reality, and as resting on no solid foundation.

The preceding results show also that errors have crept in by the adoption of the theoretical method of reducing undulatory surfaces to a level. M. de Pambour extends the length of the road as a compensation for the acclivities or for the help afforded by the bank engines, and Dr. Lardner diminishes the time of the trip to that which he assumes would be occupied in performing it on a dead level. If the principles on which these corrections for the acclivities and declivities are made be correct, other facts than we are at present acquainted with must be taken into account before it can be demonstrated that a given power will convey a given load at some certain increased velocity along a level compared with the actual velocity along any given undulating line. The resistances which enter into the composition of the sum of the forces are ever varying to such an extent, that it may be doubted whether the theoretical level be not a pure fiction with reference to the practical results of the experiment.

The effective power of a locomotive engine, or the excess of power after overcoming its proper friction and the resistance from the blast, is solely expended in the generation of momentum. This which is the product of the mass and the velocity represents the useful mechanical effort exerted by the steam, and may always be ascertained under all the practical circumstances of railway traffic. The consumption of power as water, in the shape of steam, is a third quantity which may also be readily ascertained. The application which may be made of the above data is comprehended in the following propositions. First, that equal momenta would result at all velocities from an equal amount of power expended in equal times by the same engine, if the forces opposed to progressive motion and to the effective use of steam in the engines were uniform at all velocities. Secondly, the difference between the momenta generated by a unit of power in a given time at various velocities, measures the difference in the sum of the resistances opposed to the power at those velocities. Having ascertained the gross weight of an engine tender and train—their mean velocity—and the expenditure of water as steam during the trip, simple computations will inform us of

1. The mechanical effect realized by a given power at all velocities.
2. The total increase or decrease of resistance at all velocities.
3. The ratios which the increase or decrease of resistance at different velocities bear to the ratios of those velocities.

Two other results also follow from the above, and which may be termed the commercial results, viz. the amount of gross and useful tractive effect realized by an equal expenditure of power at all velocities. The difference between these is a useless quantity in a practical sense, being the costly waste of power incident to the locomotive functions of the engine and tender over and above the waste arising from the unascertained and ineffective portion of the whole power required for the blast. The reductions and computations necessary for the exhibition and development of these views are contained in two tables. They relate to forty-nine experiments, being those already referred to, and those by Mr. N. Wood, on the Great Western, and London and Birmingham Railway, and some others. One of these tables contains the velocity of the engines, the consumption of water as steam, the loads, the absolute momenta per second; the momenta generated by equal power in equal times, viz. by 1 lb. of water as steam per second; the weights of the gross and useful loads moved by equal powers, viz. by one cubic foot of water as steam, at the velocity of each experiment, with various other elements. The other table contains a summary of the ratios of the velocities and of their squares, brought into juxta-position with the ratios of the power expended to produce equal momenta, equal gross and equal useful effects, by the comparison of pairs of experiments on the engines given in the preceding table. This table also shows the influence of velocity in the expenditure of power to produce equal mechanical and equal commercial effects; and the amount of loss attributable to the increase of resistance at the higher velocities. The author discusses in great detail the various circumstances of these experiments, and the inferences and practical conclusions which may be deduced therefrom: and comes to the conclusion, that the determination of the performance of locomotive engines by the methods here set forth is as practicable, exact, and demonstrative of their relative powers and dynamic excellence, as the determination of duty done by pumping engines.

The intensity of the pressure on the opposite side of the piston arising from the blast has been but imperfectly stated. By some the discharge of the steam has been likened to a jet, and considered continuous. But an attentive observer can appreciate by his ear that an interval exists between the alternate discharges of steam from the two cylinders. That these jets are periodic and not continuous, is also distinctly evidenced by the audible pulsations in the chimney, even at the very highest velocities of an engine, and their duration may be measured at lower speeds. Upon this intermittent action of the blast depend, in a great measure, the resultant pressure against the piston, and the production of a sufficient current of air through the fire, both which effects would be materially changed in intensity by the substitution of a continuous for a periodic current. The precise duration of the jet or of the time of the steam evacuating the cylinder, can only be determined by direct and careful experiments; but its period may be ascertained within definite limits; for since a single discharge is completed within the time occupied by the piston in accomplishing a half stroke, and the pauses between two successive discharges are distinctly perceptible, a single blast cannot occupy the fourth part of the time of the revolution of the crank shaft, and very probably does not exceed the eighth part, or the period of a quarter stroke of the piston. Under no circumstances, then, can the pressure from the blast oppose the piston much longer than during one fourth of the stroke. With an active pressure, then, of 30 lbs. per square inch, the mean resistance from the blast would not be greater than 7¼ lbs., and with a pressure of 15 lbs. not greater than 3¾ lbs. per square inch, against the pistons. The author then proceeds to cite several observations and experiments made by himself, which are confirmatory of the preceding argument respecting the blast, and he was led conclusively to the fact, that one fifth of the power of the engine experimented upon, at working pressures of 20 lbs. and 15 lbs., was absorbed in blowing the fire; and that the escape of the steam from the cylinder was four times swifter than the motion of the piston.

The author lastly treats of the expenditure of power for a given effect by fixed and locomotive non-condensing engines. But few experiments on the expenditure of steam for a given effect by non-condensing stationary engines have been made. The relative consumption of fixed condensing and non-condensing engines has been treated of by the late Mr. Charles Sylvester, of Derby, whose knowledge and accurate theoretical analysis of the subject are shown by the close accordance of his conclusions with the facts established, on two engines of these classes at certain working pressures. His conclusion that the relative economy of these engines will be as the quantities of steam consumed, or as 1 to 1·72, at those pressures, is accurately confimed by the results here recorded. Mr. Sylvester also showed, that by increasing the pressure upon the same non-condensing, and by enlarging the area of the condensing engine's cylinder and air pump, so as to maintain the steam in it at a uniform pressure per square inch for all loads, the economy of the former would gradually approach and finally equal that of the latter. The results obtained in the preceding part of the paper, furnish numerous comparisons between the locomotive and fixed non-condensing engines, and the consumption of the latter has been used, together with the condensing engine, as the test of the accuracy of the data of resistance assigned to the former by the various analysis. The accurate determination of the expenditure of steam by the same locomotive engine, in which the values of the friction and of the blast pressure were ascertained, admits of the consumption of water as steam for given effects being determined, and thus narrows the grounds of doubt, and establishes more correct data for ascertaiiing the real resistance opposed to progressive motion on railways. The application of these principles, as borne out by the experiments of the author, and their particular bearing on the experiments which have been the subject of the previous ample and detailed discussion, form the conclusion of Mr. Parkes series of communications on steam boilers and steam engines.

ROYAL INSTITUTE OF BRITISH ARCHITECTS.

3rd Feb. 1840, W. R. Hamilton, Esq., Hon. Fellow in the Chair.

J. H. Good, jun., was elected an Associate.

A paper was read by Ambrose Poynter, Esq., Hon. Sec. entitled, "*some remarks on arabesque decorations, particularly those of the Vatican.*" An abstract of this paper appeared in the last months' Journal.

It is requisite that we should notice an error which occurred in the report of Mr. Poynter's paper on arabesque ornaments, in our last number. Some extracts had been selected from it, which owing to the unavoidable absence of the Editor, were inserted without the necessary connexion being supplied, and were, moreover, unfortunately misplaced in printing. We think this explanation due to Mr. Poynter—we hope that we shall be able, at some future opportunity, to print this very interesting paper in full, illustrated by engravings.

17th Feb., John Shaw, Esq., Fellow in the Chair.

Mr. C. H. Smith read a paper "*on the properties of various stones used for building.*

At a Special General Meeting, 21st Feb., H. E. Kendall, Fellow in the Chair.

It was Resolved—That the President Earl De Grey be respectfully requested to present to her Majesty the following address on the part of the Institute.

ADDRESS.

The President, Vice Presidents and Members of the Institute of British Architects, deeply impressed with the honour conferred upon them by your Majesty's most gracious patronage, beg leave humbly to offer their sincere congratulations on the occasion of your Majesty's auspicious marriage.

That every blessing of this life may attend your Majesty and your illustrious Consort throughout a long and prosperous reign is the earnest prayer of your Majesty's most loyal and dutiful subjects.

2d March 1840, H. E. Kendall Fellow in the chair. The following gentlemen were elected Fellows:—Charles Parish, George Alexander, and David Brandon from the class of Associates;—Associate, Evan Christian.

T. L. Donaldson, Esq. Fellow, read a paper "*on the recent discoveries made at the Porta Maggiore, Rome,*" communicated by Signor Canina, Hon. and Cor. Member.

Mr. C. H. Smith read the conclusion of his paper "*on the properties of stone used for the purposes of building.*

Monday, March 16, George Moore, Fellow, in the Chair.

The following gentlemen were elected: as Fellow, Edward J'Anson, jun.; as Associates, William Hinton Campbell, of Bath, and George Pownall.

Anthony Salvin, Fellow, presented ten guineas for the purchase of books.

T. L. Donaldson, Esq., read a paper on a system of framing for floors and roofs of large span, and applicable to bridges, whether of timber or iron, communicated by Herr Laves, architect of Hanover, Hon. and Cor. Member.

Question respecting the origin of the vertical line in architecture, and the return to the horizontal line in Italian buildings. By Sir Gardner Wilkinson, Hon. Fellow.

In offering the following observations to the consideration of the Institute, it is not my object to suggest, but to elicit an opinion upon the subject; feeling as I do that it would be presumption for me to do more than state the facts which have led to my remarks, when I had an opportunity of submitting it to those who are so capable of giving it a satisfactory explanation.

It is universally admitted that the principal features which distinguish Greek from what may be called Church Architecture, are the horizontal line in the former, and the vertical in the latter; and some have supposed that to church architecture is to be ascribed the origin of the vertical line. That it is common to buildings of the Saracens, the Lombards, the Saxons, and the Normans, as well as to those of the pointed style, is sufficiently obvious: thus far our experience tells us we have traced it, but beyond this, conjecture has not attributed to it an existence, nor has its origin been ascribed to any more remote source.

In the oldest Saracenic Mosques, erected about the middle of the 7th century, the style of architecture is evidently borrowed from Roman buildings. Their arches are simply imitative of the Roman style; the windows though small have a round arched head; the corridors are formed of avenues of single slender columns supporting round arches, and the type of the Roman original is readily traced; as in the earliest churches of Europe, which also present the round arch of the Roman style. But in both these we find the lines already vertical; and that this might be expected from what we see in the monuments of ancient Rome, is the point to which I wish particularly to advert.

Those buildings erected by the Romans in imitation of the Greek, as temples, and some other monuments of a borrowed style, present the horizontal line of that architecture to which they really belonged, and of which they were copies; and since we find this to be the case in all countries of modern Europe where Greek architecture is imitated (even though it is notorious that the vertical line is the prevailing feature of our taste) we cannot be surprised that the same should have been done by the architects of Rome. But whenever the Romans attempted any thing of their own, in which they thought a deviation from Greek models was allowable, we no longer perceive the horizontal, but the vertical line predominating; and to such an extent, that even a Greek entablature is sacrificed to this their favourite sentiment, being broken up into detached parts and compelled to project and recede, in order to allow the vertical line to pass continuously through it to the summit of the building.

In an arch of triumph, a Roman composition, though the mouldings and many other details are borrowed from the Greek, the vertical line commences with the pedestal of the columns appended to its side, and extending upwards with the column, breaks through the entablature, which it obliges to come forward to carry out and mark its direction, requires a projection of the attic to correspond with the capital above the cornice, and terminates in a statue; thus continuing it uninterruptedly from the base of the summit of the building. This is not confined to an arch of triumph; the same occurs in other monuments; a remarkable instance of which may be cited in the remains of the Forum Palladium, or Forum of Nero, (according to the Chevalier Bunsen), where the whole entablature is made to advance from the face of the wall to the distance of SEVERAL feet, and is crowned by a similar projection of the attic, in order to correspond with the vertical line of the column which supports it; and the same taste for breaking up the horizontal line of Greek entablatures may be seen in numerous Roman buildings, the neplus ultra of which occurs in the monstrosities of Petra.

Thus then we find the vertical line did not originate with the architecture of Christian Europe; it occurs in the monuments of ancient Rome; and this interesting question naturally suggests itself,—whence did it proceed, was it of Italian origin?—In the Rome of a Christian era the same occurs throughout its churches; which is the more remarkable, as those churches are not of what has been termed Gothic, but of Greco-Roman or of Cinque-cento style; and in these the vertical line extends from the lowest to the highest part. Even domes and cupolas are not exempt from its intrusion; it commences with the basement of the column, and extending upwards through the projecting entablature and the attic, it continues in bands over the whole convex surface of the dome, requires a corresponding pilaster or half column in the lantern, and exhausts itself only in the extremity of the cross, or whatever point terminates the building: a good example of which may be seen in the cupola of St. Peter's, whose façade, a memento of Bernini, not only unites the most glaring defects in taste, but affords an illustration of the worst application of the vertical line. After viewing these monuments, and observing the feeling which pervades them, every one must be surprised at the sight of the splendid palazzi of Rome, and other cities of Italy. In these we no longer perceive the vertical, but the horizontal line predominating, which is carried out with wonderful effect, both in the rich and splendid cornices that crown the building, and in the string courses beneath the windows. In these no broken entablature injures the harmouy of the straight line, no sinecure columns are suspended at the side of the walls to do nothing but spoil the effect of the whole mass, and we perceive that their architects did not put together a number of details to form a whole, but conceived the whole, and made the details accessory to the general effect. So evident indeed is this, that the details are sometimes bad, and still the whole is excellent; as in many pictures of the great masters, where the composition and execution of the painting are of far greater importance, and far more striking to an artist than the imperfection of an accessory; like the sandal in the picture of Apelles.

Whence came it that Italy adopted this horizontal style, in which she has given such magnificent and graceful monuments? They are her own; and no Greek models were the origin of these noble conceptions. This is another interesting question; and it is with a view to obtain some explanation respecting *the origin of the vertical style in ancient Rome, and the return to the horizontal style in the palaces of modern Italy*, that I have offered the foregoing remarks to the Society; fully persuaded that many here present have been struck with the same curious facts, and are enabled to offer an explanation of them, which my inexperience on such a subject forbids me to suggest.

SELECT COMMITTEE ON RAILWAYS.

[SECOND REPORT TO THE HOUSE OF COMMONS.]

The select committee appointed to inquire into the state of communication by railways, and who were empowered to report their observations, together with the minutes of evidence taken before them from time to time, to the House; have further considered the matters to them referred, and have to report, that they have taken into their consideration the following clause which has been referred to them by the House :—

"And be it enacted, that no bridge or tunnel, or approaches to the same, for carrying a turnpike-road over or under any part of a railway or canal, shall be made or constructed of less width between the fences, walls, or parapets thereof than 21 feet; nor shall any bridge or tunnel, or approaches to the same, for carrying any other public carriage-road over or under any part of a railway or canal be made or constructed of less width between the fences, walls, or parapets thereof than 16 feet; nor in any case less than so much greater width, not exceeding 30 feet, as may be the average width of the turnpike or other public carriage-road for 100 yards on each side of that part of the railway or canal where any bridge or tunnel is intended to be made or constructed."

Your Committee have upon this subject examined Mr. Palk, the legal adviser of the Chairman of Committees in the House of Lords, and it appears from his evidence, that about the end of the year 1836, complaints were made to the Chairman of the Committees, and he introduced clauses into all subsequent railway bills, containing the provisions here annexed, and which your Committee will now proceed to compare with the clause referred for their consideration.

The rule which since that period has, with few exceptions, been adopted by the Chairman of Committees in the House of Lords, provides that the width of turnpike roads passing under bridges or tunnels should be 25 feet, and the width of highways passing under bridges or tunnels should be 15 feet.

The clause referred to your Committee for their consideration provides, that no bridge or tunnel for carrying a turnpike-road under any part of a railroad or canal shall be constructed of less width than 21 feet, and no bridge or tunnel for carrying any public carriage-road under any part of a railway or canal, shall be constructed of less width than 16 feet.

It will be perceived, therefore, that as regards a turnpike-road, the clause referred to your Committee requires a less width by four feet than has been required by the rule adopted in the House of Lords, while, as regards a highway or public carriage-road, an additional width of one foot is required more than has been deemed necessary by the regulations of the House of Lords. These regulations further provide, that the height of a bridge or tunnel passing under a railway should be 16 feet. This appears to your Committee to be also an important regulation. It will be found in the evidence annexed to the second report of the Committee on Railways in the last session, that it has been especially provided that the bridges or tunnels for carrying turnpike-roads under the Brighton Railway shall be 18 feet in height, and it is stated that this height was insisted upon for the convenience of the farmers and hop growers in that district. The rule of the House of Lords also requires that the width of a turnpike-road upon a bridge passing over a railway must be 25 feet, and the width of a public carriage-way 15 feet, with a parapet-wall in each case four feet high. A reference to the analytical table in the appendix to the second report of the Railway Committee of last session, will show that these regulations have been introduced into all the Railway Acts since the year 1836.

Your Committee would now recommend to the House that in all original Railway Acts, and in all Railway Acts authorizing new works in the present session of Parliament, the rule of the House of Lords should be adopted as to works to be carried into execution under the provisions of those Acts respectively, with this addition, that in every bridge or tunnel the arches should spring from abutments of not less height than 10 feet. Your Committee would also recommend that in all Railway Acts authorizing further works, passed in any future session of Parliament, the rule shall be as follows, with respect to works to be carried into execution under the provision of those Acts respectively :

Whenever a turnpike-road passes under a railway, the width of the bridge or tunnel shall in no case be less than 30 feet, and there shall be on each side footways of 2½ feet in width. Whenever a public carriage-road passes under a railway, the width of the bridge or tunnel shall be not less than 20 feet, and there shall be on each side footways of 18 inches wide; the height of the bridge or tunnel shall in no case be less than 16 feet, and the arches shall spring from abutments of not less than 10 feet in height.

Similar provisions might also, with advantage, be made applicable to all canal bills which shall in future be introduced into Parliament.

Statistics of Gas.—For lighting London and its suburbs with gas, there are 18 public gas works; 12 public gas work companies; 2,800,000*l*. capital employed in works, pipes, tanks, gas-holders, apparatus; 450,000*l*. yearly revenue derived; 180,000 tons of coal used in the year for making gas; 1,460,000,000 cubic feet of gas made in the year; 134,300 private burners supplied to about 400,000 consumers; 30,400 public or street consumers.—About 2650 of these are in the city of London.—380 lamplighters employed; 176 gas-holders, several of them double ones, capable of storing 5,500,000 cubic feet; 890 tons of coals used in the retorts on the shortest day, in 24 hours; 7,120,000 cubic feet of gas used in the longest night, say 24th December; about 2500 persons are employed in the metropolis alone in this branch of manufacture; between 1822 and 1827 the quantity nearly doubled itself, and that in five years; between 1827 and 1837 it doubled itself again.

Portsmouth Floating Bridge.—This bridge, which will shortly be opened, is seventy feet in length, and sixty in breadth, and is capable of holding on each side, besides passengers, two rows of carriages seventy feet long; she is impelled by two engines of twenty-horse power each, the cylinders being eighteen inches in diameter, and the length of the stroke three feet. The average rate of the engines will be about thirty strokes per minute, and the average speed about 350 feet per minute; so that she will perform the passage (2200 feet) in about seven minutes. She only draws, with all her machinery on board, two feet and nine inches, and fifty tons additional weight will only sink her four inches.

STEAM NAVIGATION.

The *Nemesis* iron steam ship, 165 feet long, 29 feet beam, 660 tons, built by John Laird, of the Birkenhead Iron Works, Liverpool, with engines of 120 horse power, made by George Forrester and Co. Liverpool. On her passage from Liverpool for Odessa, she struck on a sunken rock when going 9 knots per hour the damage she sustained was trifling, requiring only about 2½ cwt. of new iron, and 12 men about 6 days to repair it; not a rivet was started—the injury was confined to the part actually *dinged or cut ;* the repairs might have been completed in three days at Liverpool, where every convenience could have been had. It is stated by some parties, well acquainted with the circumstances, that had the vessel been timber built, she would not have been got off at all; but all agree that had she got off the repairs would have been both tedious and very expensive. The leak caused by the blow was so trifling that the *Nemesis* might have steamed for months without being obliged to dock. The accident occurred about the 10th ult., she steamed 300 miles afterwards, was discharged, docked, repaired, reloaded and ready for sea again by the 26th ult., with all her stores and coals on board.

PROGRESS OF RAILWAYS.

CROYDON RAILWAY.

Mr. Cubitt's Report to the Directors on the Cost of constructing the Railway.

[We have given this report in full, as it contains a great deal of valuable information to the profession.]

Gentlemen, *London, March* 9, 1840.

"The object of this report is to set forth the cost of constructing the Croydon Railway.

"In performing this duty it will be necessary to refer back to a period previous to the general meeting in August last, at which time the affairs of the Company were undergoing an examination by a committee of proprietors, by whom I was called upon, to aid and assist them in their labours.

"As much dissatisfaction at that time existed with regard to the great cost of the works, and the little information which existed on the subject, it occurred to me that nothing could tend to satisfy the minds of the proprietary so much as a clear statement of the cost of all the various parts of the work, and in a short report of the Committee of the 7th of August, I stated the way and manner, and the number of heads in which I recommended the accounts to be called for, and which were as follow :—

I. Acts of Parliament, including all legal and professional charges of all kinds incurred in soliciting and passing the various bills; the whole drawn out in a detailed form.

II. Land, buildings, and compensations of all kinds for the line of railway, and stations, together with all legal charges attending the same, and the expenses of all kinds attendant on obtaining possession of the land, &c., in detail.

III. Earthwork, bridges, fencing, draining, and forming the line of railway, as per contracts and otherwise, and also all extras upon contracts, setting forth in a clear and detailed form the whole cost of formation, bridging, fencing, draining, &c., up to the line of ballasting.

IV. Ballasting, sleepering, and laying the permanent way complete, including all turn-plates, sidings, and expenses of all kinds attending the trackways of the line.

V. Water apparatus, including engines, pumps, standards, pipes, and erections of all kinds relative to supplying the locomotive engines with water.

VI. Stations, showing the amount of contracts, and an account in detail of all extras thereon.

VII. Engine and carriage houses, workshops, implements, machinery and apparatus of every kind, for repairing and maintaining the locomotive engines, &c.

VIII. Wharfs, railway cranes, and works connected with the Grand Surrey Canal Junction.

IX. Sundries of various kinds not reducible to the above heads.

X. Engineering and supervisal of all kinds.

"Such were the accounts which I recommended the Committee to obtain, and which statement was remitted to the engineer as instructions to furnish to me, in detail, the accounts as therein specified.

"This requisition, which involved much labour and of necessity would occupy a great length of time, was most readily and cheerfully responded to by Mr. Gibbs, who not only caused the whole of the engineering accounts and expenditure to be arranged in detail under their respective heads, from III to IX. inclusive, but induced Messrs. Grissel and Peto, the contractors for the stations and buildings, to do the same with all their work, and who, much to their credit and at a very heavy expense, furnished in detail a minute account of all the work executed by them for the Company.

"To the heads, Nos. I, II, and X, I have not received any returns, but as they form no portion of the construction of the railway, and the first two not being in the engineer's department, and the last relating to private and personal accounts of the Company, may be considered as sufficient reasons for not being included in this inquiry.

"As it will be difficult, if not impossible, in a report of this kind, (which is intended to afford as much general information as possible in the shortest compass, and in a way to be understood by the general body of the proprietors) to enter very minutely into the accounts, I shall therefore submit to the board a general abstract or statement of the whole work, under the separate heads contained in my instructions, dividing each head into the principal items of costs of which it is composed, and refer for further particulars to the books themselves, premising that every entry in the book, or statement furnished to me, is referred to original day-book, journal, or ledger, in which the accounts have been entered and kept; and I have the assurance of the parties by whom the accounts have been analyzed, that out of the whole amount there are not 500*l*. for which vouchers are not producible, and which, in so large an amount, of which I had heard it surmised that no regular accounts had been kept, I think it very unsatisfactory.

"Of course, it is not in my province to go through and compare every entry in a voluminous and mixed set of accounts: a return has been made to me, as nearly as possible in the spirit and letter of my instructions, and that not in the form of a mere abstract but in great detail, and with every entry referred to the book from which it was extracted; which books, also, as before observed, were sent to me for inspection, and are now in my possession; and if it would be any satisfaction to the board or the proprietary, I shall have no objection to attend the general meeting therewith, and to afford any information and explanation in my power on the subject; but the following abstract of the accounts will show in what way the capital of the Company has been disposed of, as far as works, buildings, and machinery, are concerned.

"Such is the statement of cost which I have been enabled to make out and submit to the meeting, and which I have no reason to think is otherwise than correct, depending of course on the correctness of the data from which it was formed, but which I have no cause to doubt; the books, however, are before the meeting, and will be found, I think, to bear both external and internal evidence of being original documents, with entries made at the time; and in my judgment not the less valuable in this case for not being the most perfect system of bookkeeping that could be devised.

"As regards the correctness of the charges and the amount of works done over and above the contracts, there is no means of proving it in every instance, especially in day-work and sundries, which form a large amount. An approximate check might certainly be obtained as to the success of cuttings in flattening slopes, and getting out slips in the large contracts, by going into a remeasurement of those portions of the work, but this would involve a considerable expense, and it is doubtful whether the result would justify the expense to be incurred: still I am ready to go into it if the Board think it proper to do so. In connection with this part of the subject, it is due to the engineer to state, that I have been furnished with the cross sections and dimensions of all the extra cuttings from which the accounts were deduced; and in conclusion, I may be again allowed to observe, that on the part of Mr. Gibbs, your principal engineer, and Mr. Dean, the assistant engineer, there has been no lack of information, and that my acknowledgments are due to those gentlemen for the promptitude and readiness with which my inquiries have at all times been met.

"On the whole, then, after a careful and laborious investigation of the subject, I have no hesitation now in recording as my deliberate opinion, that which I had the honour to express verbally to a meeting of this Company some time before the railway was open to the public, and whilst the conduct of the Board at that time and the state of the expenditure were under the investigation of a Committee, viz.—that as far as the works are concerned (excepting any errors of admeasurement), there is value received, although probably at a high price, on account of circumstances in materials and labour for the money; and that the railway is well and durably laid; and that whatever want of judgment there may have existed in making out the original estimates, and lack of knowledge as to the extent to which the works would ultimately be carried, there has, in my opinion, been no want of honesty either in the management or the executive, as regards the execution of the works.

I have the honour to be, &c.,
"W. Cubitt."

TABLE OF COSTS.

	£	s.	d.
Head No. III. of Instructions—Formation of Line.			
1*st—Earthwork.*			
Forest Hill	26,703	13	9
New Cross Hill	30,131	2	4
Sydenham	11,718	2	3
Croydon	4,527	5	9
Total of Earthwork	73,080	4	1
2*nd—Fencing, Draining, and preparing for Ballast, &c.*			
Forming the way	426	0	4
Fencing, soiling slopes, &c.	4,649	11	6
Fencing and planting	6,763	3	7
Surface draining	2,817	19	0
Gates	486	9	2
Slips and extra slopes	11,138	11	11
Total forming Slips, &c.	26,281	15	0
3*rd—Bridges and Culverts.*			
Viaduct at Corbet's Lane	9,374	13	8
Boundary Walls at ditto	559	6	3
Timber Viaduct	2,505	15	0
Black Ditch Bridge	5,062	6	10
Surrey Canal Bridge	7,361	11	1
Cold Blow Farm ditto	618	12	2
Footbridge, Five Bell Lane	456	14	6
New Cross Bridge	3,161	7	0
Finches' Bridge	2.603	9	5
Deptford Common Bridge, No. 1	628	8	6
Ditto ditto No. 2	1,102	3	0
Calgate's Bridge	1,353	12	10
Owen's Bridge	1,032	12	11
Colson's Bridge	873	18	8
Sydenham Bridge	2.981	7	6
Anerley Bridge	1,761	13	6
Jolly Sailor Bridge	2.612	5	1
Croydon Common Bridge, No. 1,	1,069	3	10
Ditto ditto No. 2.	1,136	0	11
Cross Road Bridge	1,394	2	0
Total of Bridges	47,649	4	8
4*th—Culverts.*			
Deptford Common Culvert	451	5	4
Ditto ditto	412	9	3
Forest Wood ditto	129	0	9
At New Cross	1,418	18	11
,, Sydenham	1,786	19	1
,, Selhurst	115	17	9
Total of Culverts	4,315	1	1
5*th—Retaining and Boundary Walls.*			
Turner's and Sterry's	666	1	8
At Sydenham Bridge	3,451	7	3
Sydenham Station Walls	374	0	7
Jolly Sailor ditto	611	12	3
Dartmouth Arms ditto	1,513	14	8
Sundry Walls	141	0	2
Total of Retaining and Boundary Walls	6,757	16	7
6*th—Diversion of Roads, &c. &c.*			
At Cross Roads Bridge	448	11	7
Brockley Road	15	15	6
Dartmouth Arms ditto	543	1	0
New Cross	533	3	11
Viaduct Road	73	4	9
Sydenham Bridge	33	19	0
Jolly Sailor	101	3	0
Penge and Anerley Roads	350	0	0
Approaches to Nos. 1 & 2 Bridges	770	13	4
Surrey Canal Bridge Road	13	16	9
Sundry other Roads	1.936	15	0
Total making and altering Roads, &c. &c.	4820	3	10
Total of construction to Formation level.	162,904	6	3
Head No. IV. of Instructions, viz.—Ballasting, Draining, Timbering, and laying Permanent Way.			
1st—Ballasting the Line, exclusive of London Bridge Station	17,373	15	0
2nd—Drainage of Permanent Way	2,788	1	10
	20,161	16	10
3*rd—Timbering the Line.*			
Sleepers, timber, and preparing do.	24.890	8	10
Carriage of timber	1.943	9	2
Kyanizing ditto	4.793	3	8
Laying sleepers	5,113	8	2
Tarring ditto	223	17	11
Felt for rails	663	5	10
Total of timbering the line	37,627	13	7
4*th—Rails and Laying.*			
Rails, screws, and bolts	24.785	10	8
Labour and laying rails	968	17	0
Carriage, and removal by hand of ditto	1.847	19	5
Turnplates	2,151	1	10
Total of laying rails	29,753	8	11
	87,542	19	4
Head No. V. of Instructions.—Water Supplying Apparatus.			
At London Bridge Station	923	10	1
New Cross ditto	3,190	2	11
Croydon ditto	1,555	2	2
Total of water apparatus	5.668	15	2
Head No. VI. of Instructions—Cost of Stations.			
At London Bridge	40.301	5	8
New Cross	21,919	18	5
Dartmouth Arms	1,344	10	8
Sydenham	134	3	4
Penge and Anerley	454	2	4
The Jolly Sailor	2.366	0	4
Croydon	12.215	19	9
Total of Stations	78,736	0	6
Head No. VII. of Instructions, included in No. VI.			
Head No. VIII. of Instructions—Wharfs at Surrey Canal Junction and Croydon.			
1*st—Surrey Canal Wharf and Incline*	5,022	5	10
2*nd—Croydon Wharfs.*			
Wharf walls	2,750	17	5
Crane	37	0	10
Warehouses	968	4	0
Stables	86	3	0
Total of Wharfs	3.842	5	3
	8,864	11	1
Head No. IX. of Instructions—Sundries of various kinds, including Locomotive Engines, Carriages, Waggons, Consolidation of Way, &c. &c.			
1*st—Houses and Cottages.*			
Police Cottages	691	19	10
Switch Box at Junction	38	7	7
Ditto ditto at New Cross	33	8	0
Cottage at Brockley	199	12	3
Ditto ditto Selhurst	12	0	6
Storehouse, Coldblow	64	16	0
	1,040	4	2
2*nd—Lighting.*			
Light House at Junction	369	10	5
Expenses for Lighting Road.			
New Cross Station	374	10	0
Croydon Station	232	6	0
London ditto	302	1	1
Engine lamps, &c.	223	8	4
Light House at Junction	89	4	7
Ditto	349	18	7
	1,940	19	0
3*rd—Consolidation of Way*	11,146	18	10
4*th—Locomotive Engines, Carriages, and Waggons*	28,086	3	6
5*th—Miscellanea and Sundries of all and various kinds*	18,054	17	5
	60,269	2	11
Total	£403,985	15	3

"From the annexed statement arises the following general abstract, under the different heads of my instructions, viz.—

	£	s.	d.
Construction and formation of the line of railway to the line of ballasting	162,904	6	3
Ballasting and laying the permanent way	87,542	19	4
Buildings and machinery for supplying water to engines	5.668	15	2
Stations, workshops, &c.	78,736	0	6
Wharfs at Surrey Canal and Croydon	8,864	11	1
Sundries of various kinds, including locomotive engines, coaches and waggons, consolidation of way, &c.	60,269	2	11
Total cost of construction and seting to work	£403,985	15	3

Exclusive of land, parliamentary and law expenses, and engineering.

MANCHESTER AND BIRMINGHAM RAILWAY REPORT.

Mr. Buck's Report to the Board of Directors, (March 3, 1840.)

Fairfield Street Contract.—This contract is finished, with the exception of the bridge over Fairfield-street. The ironwork of this bridge is now in course of erection. Half of the main ribs are fixed, and I expect that in seven weeks from this date, all the roadway plates will be fixed. and the bridge ready to receive the ballasting. In my report of last September. I stated that the founder had undertaken to have the ironwork erected by the end of December last: however, he has been unable to work up to his calculations in this respect, by reason of the extraordinary wetness of the weather, which prevented the workmen from continuously proceeding with the fitting of the castings; an operation which, (from the nature of the work,) was necessarily performed in the open air. But it is satisfactory to state, that although some additional time has consequently been requisite for this portion of the work, the opening of the line to Stockport will not be retarded thereby.

Chancery Lane contract is finished, and the contractor for laying the permanent way is now ballasting the arches.

Hyde Road Contract.—The brick arches are all turned and ballasted, in readiness for the permanent way. About one-third of the parapet remains to be built. The ironwork for the cast iron arch over the Hyde Road, is now in progress of erection; all the main ribs, and a portion of the spandrills are fixed. I expect that the roadway plates will be ready for the ballasting in four weeks from this time.

Heaton Norris Contract.—The excavation is very nearly finished: about 8,000 yards only remain to be moved, in addition to that which has been reserved for ballasting the permanent way; and this will go out as wanted for the purpose. An opening remains in the embankment at the crossing of the Stockport Road and its diversion, where two temporary bridges have been erected during the construction of the permanent one. The masonry for the latter is at the height for the reception of the iron arch, which is ready, and will require about eight weeks for fixing. This is the only bridge *under* the line which is not built. Of the bridges *over* the excavation, there are five of various sizes in different states of forwardness, three being nearly finished. These will all be easily completed during the time of fixing the ironwork of the Stockport Road bridge. Of the permanent way, 5,100 yards of single road have been, and 13,400 yards remain to be laid. Here more was calculated upon, but the contractor has been unable to procure sleepers so rapidly as he expected; however, in consequence of recent arrangements which he has made in reference to a more expeditious delivery, I have every confidence in his completing the whole within the period of his contract.

Stockport Viaduct Contract.—The north abutment and seven arches are finished; three other arches are in different states of forwardness, and the centre is fixing for the eleventh. The pier on the right margin of the river Mersey is erected to the height of the impost, which is partly set: the preceding ten arches comprehend all that portion of the work on the north or Lancashire side of the river. The foundation of the river pier on the left margin is just commenced. Five other piers on the south or Cheshire side are in progress, one being nearly finished, and the others in proportionate states of advance. The foundations of the three next in succession are excavated, and the south abutment is partially erected. I have great satisfaction in stating that all the foundations are upon rock.

Castle Street Contract extends from the south abutment of the Stockport Viaduct to the Mecca Brook, a distance of two miles six chains. The contractor has just commenced operations.

The designs are prepared for that portion of the line extending from the end of the last mentioned contract to Alderley, a distance of seven miles seven chains.

I have every confidence that my former statement will be realised, and that the line from Fairfield-street to Stockport may be opened in the month of May next.

Midland Counties Railway.—This line of railway will be opened from Nottingham and Derby to Leicester, in May next, and throughout to Rugby in June, in time to receive the traffic when the whole line of the North Midland is opened. This important railway is one of the few in England that will be made with the original subscribed capital. It will be in full operation without the creation of either half or quarter shares; and notwithstanding the pressure in the money-market, so great has been the confidence in this undertaking, that the directors have already been enabled to borrow nearly the whole sum authorised to be taken on loan by their Act. The cost of the line, including everything, will only be about 22,500*l.* per mile.—*Railway Times.*—This railway will untimately become one of the most important lines in the kingdom, particularly if an act should be obtained for the Nottingham, Lincoln and Hull railway, which is sure to be carried into execution sooner or later.

Gloucester and Birmingham Railway.—This company appear to be using their utmost exertions to hasten operations along that portion of the line promised, in their late report, to be opened in the spring. On Monday last the directors and engineers inspected the works at the Cheltenham station, with the state and condition of which they expressed themselves much pleased; and, proceeding on the railroad to Tewkesbury, examined in like manner the different works in that neighbourhood. The return from Tewkesbury was accomplished in sixteen minutes; we believe the distance has been gone over before in thirteen. The engines to be employed on this line, if that now at work is to be taken as "a sample for all the rest," promise to equal, if not excel, those of any of the other railroads in the kingdom.—*Cheltenham Looker-on.*

MISCELLANEA.

A buried Village.—We find, in the *Progres du Pas de Calais*, the following account of the accidental discovery of a subterraneous village in the commune of Hermies, near Bapaume, which we are inclined to receive with some hesitation, till we meet with a confirmation of the statement. It is therein said, that during the late heavy rains a great land-slip took place close to Hermies, into which some of the young men of the place had the hardihood to descend, by means of ladders tied together. What was their surprise, to find themselves, at a depth of thirty metres, in the midst of handsome streets, bordered on both sides by cells and chambers, which had evidently been once inhabited! The streets are of width sufficient to admit of a carriage passing; and the chambers, of various sizes, are also of various degrees of comfort and elegance. Some are flagged; and their number is said to amount to between twelve and fifteen hundred. Among the objects by which the explorers were more particularly struck, was an old stone tower, with a winding staircase. This they ascended, and, having beaten through the vaulted roof, discovered that it opened into the belfry of the church of Hermies.

Architecture.—The Rev. John Parker, M.A. lately delivered a course of Lectures on Gothic Architecture before the members of the Shropshire and North Wales Natural History and Antiquarian Society. The lectures were principally directed to an explanation of the scientific construction of gothic vaulting, with a dissertation on the superiority of the upright or pointed gothic arch over the circular arch of the Anglo-Norman and other schools of architecture. The pre-eminence of the gothic vault in the conveyance of sound, and of the upright or pointed arch in the great particulars of lightness and strength, were clearly shown and most happily described.—Sections of ribbed work from gothic vaulting in Valle Crucis Abbey, the Castle of Beaumaris, Tintern Abbey, the Old Chapel of St. Stephen (the late House of Commons), Shiffnal Church, the Priory of Kennilworth, the White Abbey (in this county), St. David's Cathedral, Lichfield Cathedral, and Stoneleigh Abbey, were produced, with a model in wirework that pourtrayed the several forms in which the ribbed work of gothic vaulting could be made available by the artist; while the superiority and beauty of the pointed arch were illustrated by drawings made by Mr. Parker on visits to Kilpec Church, near Hereford, and to the ruins of Valle Crucis Abbey, aided by the more simple but effective application of scientific acquirement to that practical illustration which the course of lectures required to be made during the progress of its delivery. —*Salopian Journal, Feb.* 5, 1840.

LIST OF NEW PATENTS.

GRANTED IN ENGLAND FROM 29TH FEBRUARY, TO 28TH, MARCH 1840.

James Beaumont Neilson, of Glasgow, Gentleman, for "*certain improved methods of coating iron under various circumstances, to prevent oxidation or corrosion, and for other purposes.*"—Sealed February 29; six months for enrolment.

Rowland Macdonald Stephenson, of Upper Thames Street, Civil Engineer, for "*an improved method or methods of adjusting, shifting, and working theatrical scenery and apparatus.*"—February 29; six months.

Richard Edwards, of Fairfield Place, Bow, Dealer in Emery Cloth, for "*improvements in preparing and combining of materials used in lighting or kindling fires.*"—February 29: six months.

John Sylvester, of Great Russell Street, Engineer, for "*improvements in the construction of doors and frames for closing the openings of fire places, ash pits, flues, chimneys, and certain retorts.*"—March 3; six months.

Joseph Shore, of Birmingham, Merchant, for "*improvements in preserving and covering certain metals and alloys of metals.*"—March 3; six months.

James Horne, of Clapham Common, Esquire, for "*improvements in the stuffing-boxes of lift pumps.*"—March 3; six months.

Joseph Clisild Daniell, of Limpley Stoke, Bradford, in the county of Wilts, for "*an improved method of preparing shoot or weft to be used in weaving woollen cloth and cloths made of wool and other materials.*"—March 3; sfx months.

John Rangeley, of Camberwell, Gentleman, for "*improvements in the construction of railways, and in the means of applying power to propelling carriages and machinery.*"—March 3; six months.

William Craig, of Glasgow, Engineer, and William Douglas Sharp, of Stanley, Perthshire, Engineer, for "*certain improvements in machinery for preparing, spinning, and doubling cotton, flax, wool, and other fibrous substances.*"—March 3; six months.

Joseph Newton, of High Bridge Mill, York, Manufacturer of Fancy Cloths, and George Collier, of the same place, Mechanic, for "*an improvement in looms, for the weaving of figured or twilled fabrics.*"—March 4; six months.

Joseph Bower, of Hunslet, York, Soda Ash Manufacturer, for "*certain improvement in the manufacture of carbonate of soda.*"—March 4; six months.

Charles Alexander Pellerin, of Leicester Square, Gentleman, for "*improvements in wind and stringed musical instruments.*" Communicated by a foreigner residing abroad.—March 4; six months.

Charles Kober, of Leadenhall Street, Cloth Manufacturer, for "*improvements in fixing colour in cloth.*"—March 7; six months.

Caroline Julia Sophia Cox, of Addison Road, Kensington, Spinster, for "*an improved mode of fastening and uniting the edges of the divided parts of shoes, boots, bandages, packages, and other articles of dress or utility.*"—March 7; two months.

Joseph Atkinson, of Roundhill, York, Farmer, for "*improvements in thrashing and winnowing-machine.*"—March 7; six months.

Robert Molyneux, of Southampton Row, Chronometer Maker, for "*an improvement or improvements in chronometers.*"—March 7; six months.

William Matlby, Junior, of Mile End, Chemist, and Richard Cuerton, Junior, of Percy Street, Brass Founder, for "*improvements in extracting and concentrating the colour, tanning, and other matter contained in vegetable and animal substances.*"—March 7; six months.

Luke Hebert, of Birmingham, Civil Engineer, for "*improvements in the manufacture of cofered spades and shovels, soughing and grafting tools, and other implements of a like nature.*"—March 7; six months.

Hayward Tyler, of Milton Street, Cripplegate, Engineer, for "*certain improvements in machinery or apparatus for impregnating liquids with gas, including bottles for retaining, keeping, and preserving liquids so impregnated, also in the manner of filling and closing such bottles.*"—March 7; six months.

James Knowles, of Little Bolton, Lancashire, Coal Merchant, for "*an improved arrangement of apparatus for regulating the supply of water to steam boilers.*"—March 10; four months.

George Gwynne, of Portland Terrace, Regent's Park, Gentleman, for "*improvements in the manufacture of candles, and in operating upon oils and fats.*"—March 10; six months.

William Forrester, of Barrhead, Renfrew, Manager, for "*certain improvements in sizing, starching, dressing, and otherwise preparing warps for weaving fabrics, and on the machinery and apparatus therewith connected.*"—March 11; six months.

Thomas Peel, of Bread Street, Cheapside, Gentleman, for "*certain improvements in steam engines.*" Communicated by a foreigner residing abroad.—March 11; six months.

Richard Smith and Richard Hacking, of Bury, Lancaster, Machine Makers, for "*certain improvements in machinery and apparatus for drawing, slubbing, roving, and spinning cotton, wool, flax, silk, and other fibrous substances.*"—March 13; six months.

Etienne Robert Gaubert, of Paris, Professor of Mathematics, for "*certain improvements in machinery or apparatus for distributing types or other typographical characters into proper receptac.es, and placing the same in order for setting up after being used in printing.*"—March 13; six months.

James Hadden Young, of Lille, in the kingdom of France, and Adrian Delcombe, of Lille aforesaid, for "*an improved mode of setting up types.*"—March 13; six months.

Robert Varicas, of Burton Crescent, Surgeon, for "*improvements in rendering fabrics and leather waterproof.*"—March 16; six months.

William Crofts, of Radford, Nottingham, Machine Maker, for "*improvements in machinery for the purpose of making figured or ornamented bobbin net or twist lace, and other ornamental fabrics, looped or woven.*"—March 16; six months.

Jean Francois Victor Fabien, of King William Street, London, for "*improvements in rotary engines to be worked by steam or other fluids.*"—March 16; six months.

Thomas Craddock, of Broadheath, Radnor, Farmer, for "*a certain improvement or improvements in steam engines and steam boilers.*"—March 16; six months.

Richard Smith and Richard Hacking, of Bury, Lancaster, Machine Makers, for "*certain improvements in machinery for spinning cotton and other fibrous substances.*"—March 16; six months.

Isham Baggs, of Cheltenham, Gentleman for "*improvements in engraving, which improvements are applicable to lithography.*"—March 17; six months.

Moses Poole, of Lincoln's Inn, Gentleman, for "*improvements in producing and preparing leys for soap making, and in the manufacture of soap.*" Communicated by a foreigner residing abroad.—March 17; six months.

Samuel Seaward, of the Canal Iron works, Poplar, Engineer, for "*certain improvements in the construction of steam engines and in the application of steam engines to propelling ships and other vessels.*"—March 17; six months.

Sir William Burnett, Knight, of Somerset House, for "*improvements in preserving animal, woollen, and other fibrous substances from decay.*"—March 19; six months.

John Jackson, of Manchester, Nail and Bolt Manufacturer for "*certain improvements in the manufacture of nails, nuts, bolts, and rivets.*"—March 19; six months.

Thomas Sterling, of Limehouse, Patentee of the "rapid filterer" for "*improvements in the manufacture of fuel.*"—March 20; six months.

Francis William Gerish, of East Road, City Road, Patent Hinge Maker, for "*improvements in locks and keys and other fastenings for doors, drawings, and other such purposes.*"—March 20; six months.

Charles Keene, of Sussex Place, Regent's Park, Gentleman, for "*improvements in producing surfaces on leather and fabrics.* Communicated by a foreigner residing abroad.—March 23; six months.

William Newton, of Chancery Lane, Civil Engineer, for "*certain improvements in the strengthening and preserving of ligneous and textile substances.* Communicated by a foreigner residing abroad.--March 23; six months.

Samuel Hill, of Sloane Street, Chelsea, Gentleman, for "*improvements in the making of bread and biscuits.*"—March 25; six months.

Elhanan Bicknell, of Newington Butts, Surrey, Merchant, for "*improvements in separating the solid from the liquid parts of tallow, and other fatty matters.*" Communicated by a foreigner residing abroad.—March 25; six months.

William Palmer, of Sutton Street, Clerkenwell, for "*improvements in the manufacture of candles. and in apparatus for applying light.*"—March 25; six months.

Henry Smith, of Birmingham, Lamp Manufacturer, for "*improvements in gas burners. and in lamps.*"—March 25; six months.

George Richards Elkington and Henry Elkington, of Birmingham, for "*improvements in coating, covering, or plating certain metals.*"—March 25; six months.

Joseph Crosfield, of Warrington, Soap Maker, for "*certain improvements in the manufacture of plate glass.*"—March 25; six months.

Samuel Knight, of Woodhouse Mills, Lancaster, Bleacher, for "*certain improvements in machinery or apparatus for boiling, bleeching, or scouring, for the purpose of preparing and assisting the process of bleeching and dyeing cotton and linen, and other fabrics and fibrous substances.*"—March 25; six months.

James Hay, of Belton, Haddington, Scotland, Captain in the Royal Navy, for "*an improved plough, which he entitles the Belton plough.*"—March 25; six months.

Henry Philip Rouquette, of Norfolk Street, Strand, Merchant, for "*a new pigment.*" Communicated by a foreigner residing abroad.—March 25; four months.

James Sabberton, of Great Pultney Street, Golden Square, Tailor, for "*a fastening to attach straps to the bottoms of trousers.*"—March 26; two months.

Alexander Southwood Stocker, of Birmingham, Manufacturer, for "*certain improvements in manufacturing tubing or tubes, which are applicable to gas and other purposes.*"—March 27; six months.

Richard Prosser, of Cherry Street, Birmingham, Civil Engineer, for "*certain improvements in machinery or apparatus for manufacturing pipes.*"—March 27; six months.

Henry Kirk, of Upper Norton Street, Portland Place, Merchant, for "*improvements in the application of a substance or composition as a substitute for ice for skating and sliding purposes, part of which improvements may also be employed in the manufacture of ornamental slabs and mouldings.*"—March 28; six months.

John Bethell, of St. John's Hill, Wandsworth, Gentleman, for "*improvements in treating and preparing certain oils and fatty matters.*"—March 28; six months.

ERRATUM.

In Mr. Leeds Chronological Table of Architects, page 113 of the present number, the works of the second architect are omitted, it should stand thus. 1708, Mansard, Jules Hardouin, 1647,—*works*, Palace of Versailles; Dome of the Invalides, Paris; &c.

TO CORRESPONDENTS.

Mr. Spencer's *communication is unavoidably postponed until next month.*

P. P. E.'s *scheme for propelling canal boats we are fearful is impracticable, however, we will reconsider it before the next number appears.*

X. Y. Z. Glasgow. *We shall feel much pleasure to record in the Journal, the many improvements that are going on in Glasgow, if our correspondent will take the trouble to see some of the architects of the North and collect information for us, we shall be obliged.*

Mr. Thorold's *design for a frame of a steam engine possesses considerable merit for its compactness, as there is no novelty in the construction of the machinery, we cannot afford space for the design at this busy season of the year.*

R. W. T. and P. B.'s *communications on railway curves must stand over for the present, as we have already devoted so much space to that subject.*

Design of Huddersfield College by J. P. Pritchet, *architect, will appear in an early number.*

—— *We shall be glad to receive his proffered communication, we cannot hear from him too often.*

H.'s *design has appeared in another publication.*

Report on the plans for preventing accidents on board of steam vessels, and Dr. Charles Schafhaeutel's report on Playfair's boiler will be noticed next month.

To our correspondent at New York we return many thanks for his exertions on our behalf.

We are happy to find by the numerous letters we have received that our advocacy in the cause of Steam Navigation meets with the approbation of our subscribers.

We recommend a correspondent, his signature we forget, to read the Fable of the Miller.

Δ *We are obliged for his letter, we have long been aware of the sinister working of the individual alluded to—he is too contemptible for our notice, "every dog has his day." We feel ourselves independent of all parties.*

The Cinque Ports *reply to our correspondent* E. *on the recessions and encroachments of the sea will appear next month, together with a communication from* NOTA, *on the same subject.*

Communications are requested to be addressed to "The Editor of the Civil Engineer and Architect's Journal," *No.* 11, *Parliament Street, Westminster.*

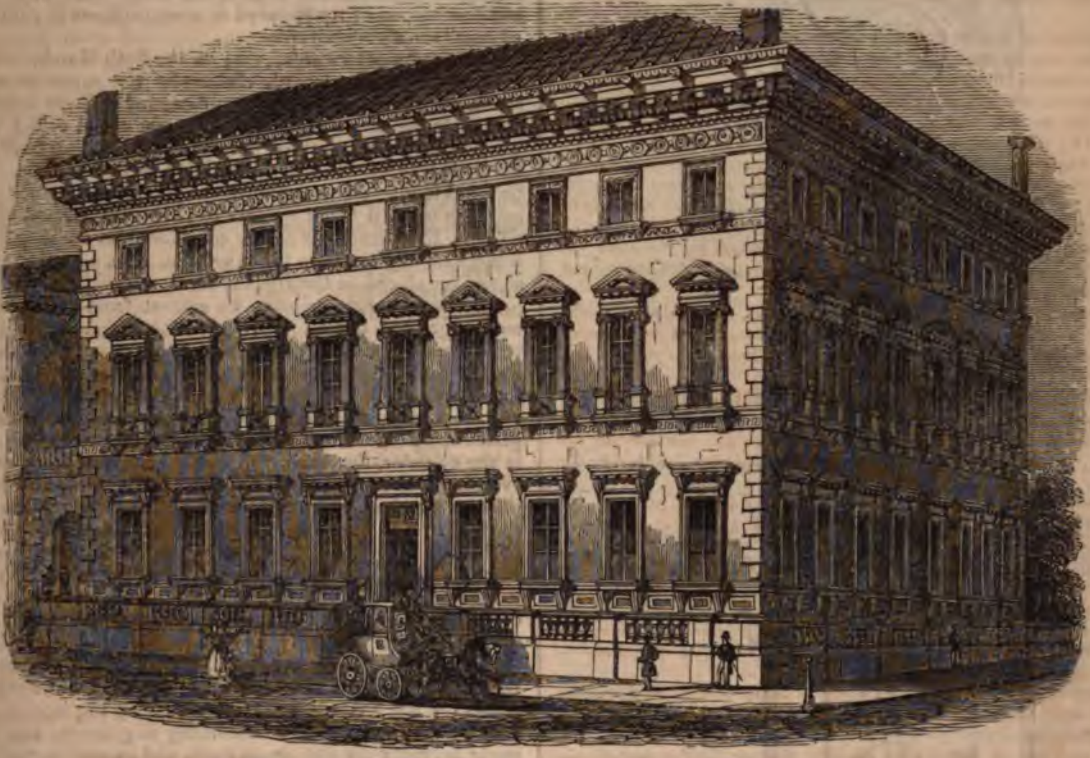
Books for review must be sent early in the month, communications on or before the 20th (if with wood-cuts, earlier), and advertisements on or before the 25th instant.

The First Volume may be had, bound in cloth and lettered in gold, Price 17*s*.

⁂ The Second Volume may also be had, Price 20*s*.

THE REFORM CLUB-HOUSE, PALL MALL.

CHARLES BARRY, R.A., ARCHITECT.



What can be said about club-houses? Their friends are silenced by their success, and their enemies cannot contend against them. Hercules might have given up his club, but the aristocracy are determined not to follow his example. Their merits and demerits are beyond our control,—one only fact we have to deal with, and that is their rapid increase. The palaces have disappeared or have been eclipsed, and the south of Pall Mall is covered with an almost uninterrupted line of temples in honour of the social principle. If the grandeur of our commercial edifices strikes the foreigner with wonder, or if he considers our parks and squares as worthy rivals of his alleys of orange trees, how can he fail to pass without notice these personifications of national characteristics. The foreigner may justly marvel to see the palace eclipsed before the shrine of Mammon, but he must be still more astonished to see the hospital front of St. James's shrinking back from the grandeur of its unroyal neighbours. The principle of association is the foundation of civilization, and the English race are influenced by it more than any other. We are Napoleon's nation of shopkeepers, mechanics and stock-jobbers to the fullest extent, who take out our amusements in shares, and raise a joint fund to provide domestic comfort. Pall Mall is the true House of Commons of the nation—here every political principle is represented, and every shade of society has its point of reunion. In this street of palaces, unique in Europe, one of the most striking is the subject of our present notice.

For the view of this building we are indebted to the *Literary World*, of whose embellishments it may be considered a very fair specimen,—one certainly greatly superior to any thing to be met with in similar publications. With regard to the structure itself, we shall not now attempt to enter into any architectural description of it, reserving such notice till we have the opportunity of rendering it complete; and shall therefore at present only observe that the Reform Clubhouse is the most perfect and imposing specimen of Italian architecture in the metropolis,—reserving, however, to ourselves, our admiration for the Garden-façade of the Travellers, as the most elegant and piquant example of that style, upon a lesser scale. In this new work of Mr. Barry's we perceive extreme simplicity and unity of design combined with a very unusual degree of richness,—an *astylar* (columnless,) with more of architectural expression than is generally produced by a display of columns forming a principal order. The breadth of the piers or spaces between the windows contributes not a little to that repose which is so essential to simplicity, and hardly less so to stateliness. The string courses are particularly beautiful parts in the design, while the cornicione gives an extraordinary air of majesty and grandeur to the whole.

It is the largest and most commodious of any of the club-houses in the metropolis: the length of the front is 120 feet, exclusive of the entrance between the Travellers' Club-house and the main building, which is fifteen; making, in all, a frontage of 135 feet. The depth of the main building is 104 ft. 6 in.; the height of the cornice from the pavement, is about sixty-eight feet.

The roof is covered with Italian tiles, manufactured expressly for this building, by Messrs. Rutledge and Keene, of the Belvedere road. The whole of the building is faced with Portland stone, it is a very fine specimen of masonry, and does credit to the contractors, Messrs. Grisell and Peto. We must not omit to mention the scientific manner in which the building was erected; a scaffolding of considerable strength was constructed of timber, and on the top was laid a railway, upon which was worked a traversing crane that could be moved along the building either longitudinally or transversely: by this means the stones were raised from the ground and placed on the wall with very little labour to the mason, who only had to adjust the bed and lay the stone. We perceive that Messrs. Grisell and Peto are about to adopt the same plan for the new Houses of Parliament, by which means they will save very considerably in the price of labour.

BRODERIP'S TROUGH OR TRUNK ENGINE.

Fig. 1.—Section.

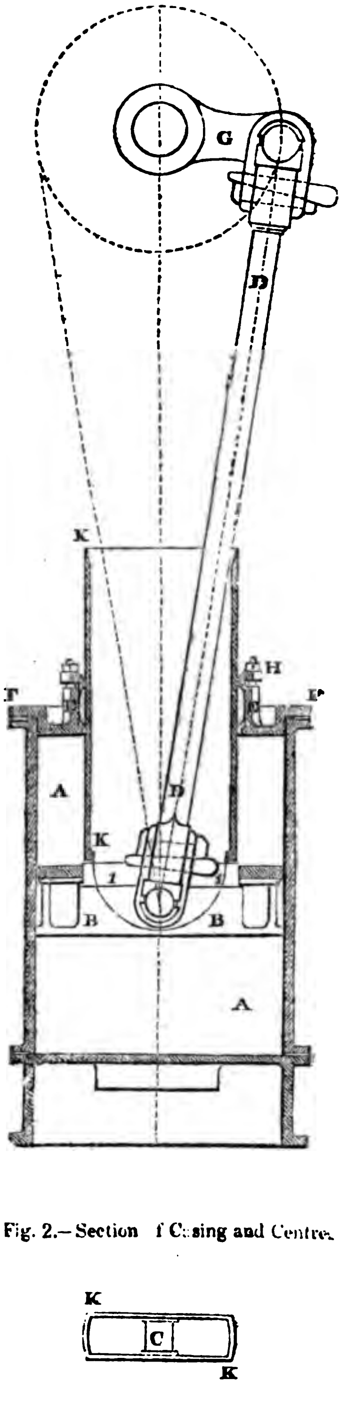
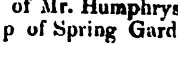


Fig. 2.—Section of Casing and Centre.



In consequence of the late discussion at the meeting of the Great Western Steam Ship Company at Bristol, relative to the intended introduction of "Humphrys' Patent Trunk Steam Engine," for the new iron steam ship now building at Bristol. We felt desirous of obtaining a drawing and some particulars relative to it :- upon making enquiries among our scientific friends, we were much surprised to find that a similar engine had been patented by another party nearly seven years antecedent to the patent of Mr. Humphrys; and was invented by the late Mr. Charles Broderip of Spring Gardens, a gentleman who was well known to the scientific world as a clever engineer and scientific man. Upwards of eighteen years ago he equipped a steam vessel called the "Tartar," with which he made a voyage into the Bay of Biscay and back, and by this spirited proceeding was the first person to demonstrate the practicability of sending steam vessels across that tempestuous bay, which, till then, had never been attempted.

He afterwards invented the application of a casing or trunk attached to the piston, by the use of which, he was enabled to connect the piston rod with the crank direct, as shewn in the accompanying drawing; he, however, died shortly afterwards, and his executor Col. D'Arcy took out letters patent for the invention, dated Nov. 29th, 1828, and a sketch and description of it appeared in a scientific work called the "Journal of Arts" shortly afterwards.

Some years afterwards, viz., on the 28th March, 1835, Mr. Francis Humphrys again patented, identically the same arrangement of the steam engine, and subsequently proceeded to make a pair of engines on this principle, that were fitted to a steam vessel called the "Dartford" which ran for a short time, but which it is stated, have since failed in the cylinders by the angular friction of the pistons. We shall now proceed to give a description of the engine as specified by both parties, and then leave it to our readers to judge how far Mr. Humphrys is entitled to his patent, or can be considered as the *original inventor*, for if there be any merit in the invention, it is only right that the saddle should be placed on the right horse.

The following description we extract from the specification of the patent granted to Col. D'Arcy:—The specification describes other improvements besides the one in question; one of them was for a *sliding stuffing box*, "the piston rod connected at one end to the piston, and at the other end to the crank of the engine without the intervention of any cross head, side rods, guide frame or parallel motion to keep the piston in a perpendicular position whilst it is ascending and descending in the cylinder, the improved method of connecting the piston of any cylinder used in a steam engine to its rod is by means of any convenient joint, or by a ball and socket which will allow the piston rod to oscillate or yield to the motion of its crank without altering the vertical or horizontal position of the piston, whilst acting either in a cylinder placed vertically or horizontally as circumstances may require; and by the introduction of the sliding stuffing box, I am enabled to apply the oscillating piston." The specification then proceeds to describe this invention by a reference to the drawings accompanying the specification. A A the cylinder, B B the piston, C C the centre of the joint of piston into which the joint of the piston rod D D is fitted and united; D D shows the rod forming its greatest angle by the motion of the crank G; E E the sliding stuffing box working in grooves, rabets or dovetails, made perfectly air and steam tight, and placed securely on the top of the cylinder cover F F. Instead of the sliding stuffing box, the patentee in some cases substitutes "*the trough or socket* K K" (showed in the annexed engravings) "firmly connected to the piston, and which trough or socket must be made hollow and of sufficient capacity to allow the piston rod D D to oscillate freely in its width, thickness, and area, so that in its transverse, through the fixed stuffing box E E, and by the gland H, the trough or socket K K may be rendered as securely air and steam tight in its connection with the cylinder A A, as if it was a cylindrical piston rod."

We shall now give some extracts from the specification of the patent granted to *Mr. Francis Humphrys:* we did not consider it necessary to give a drawing, as it is so identically like the above.

The letters in italics within parenthesis, we have introduced, they refer to the above engraving; the other letters are as they appear in Mr. Humphry's specification. "A A is the cylinder, B B the working piston, C (*G*) the crank, D D (*K K*) a steam tight casing or trunk of a rectangular form rounded at each end, which is permanently attached to the piston in such a manner that the axis of the one shall correspond exactly with the axis of the other, and which casing works up and down with the piston, E E (*F F*) is the lid or cover of the cylinder A A, G G (*E E*) the stuffing box which is made to fit the outside of the casing or trunk D D (*K K*) instead of as usual fitting the piston rod." In the concluding part of the specification, Mr. Humphrys states "that what I claim as my invention is the addition, to the pistons of steam engines, of a steam tight casing or trunk permanently affixed thereto, and working up and down therewith, and the employment of a connecting rod passing from the working piston to the crank through such steam tight casing or trunk, both in the same manner herein before specified; by means of which contrivance, the reciprocating motion of the pistons is resolved into a rotary motion without the intervention of the beams, cross heads and other auxiliary appendages in common use."

MEDIEVAL ARCHITECTURE IN FRANCE.—No. 1.

WHATEVER may be the opinions of individuals with regard to the merits of the Gothic style, it has so strong a hold on our sympathies, and so many advocates and supporters, that it can neither be neglected in a professional point of view, nor be decried as unimportant. As a branch of instruction its study is imperative, nor is it less so as coming within the domain of the antiquarian and the artist. Linking us, as this style does, in a common bond with surrounding nations, abounding in monuments not merely of local but of universal interest, its history in other countries affords not only pleasure, but becomes of value as tending to illustrate its progress here. To no other country does this apply more strongly than to France, where the architectural associations, like the political relations of the country for many centuries were interwoven with our own, springing from the same parent stock, and from time to time forming alliances which tended to keep up the mutual connection. At the same time the later and closer connection of France with the lower empire both in the east and the west has given rise to modifications which either never existed here, or of which the vestiges have become extinct, as in the case of the Romanesque and Byzantine Gothic, of which monuments are to be found there replete with the highest interest. It is for these reasons therefore that as we know that it would be acceptable to our readers we are induced to profit by the present opportunities afforded by French periodicals and other authorities of presenting a short account of the French Medieval styles in a familiar form.

In our second volume, page 193, will be found a valuable paper by Mr. Poynter, on the comparative chronology of English and French medieval architecture, founded on the investigations of M. Comon, of the Antiquarian Society of Caen.

COMPARATIVE CHRONOLOGY OF FRENCH AND ENGLISH MEDIEVAL ARCHITECTURE.

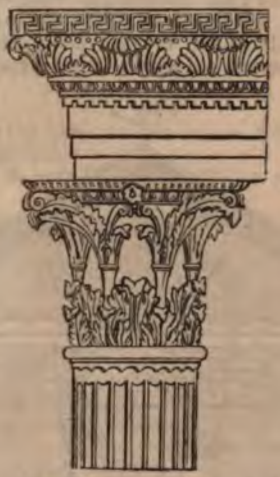
	950	Romanesque.	
	1000		
	1050	Transition.	
Norman	1100		
	1150	Primordial Gothic.	
Early English	1200		
	1250	1st epoch.	Secondary or Gothique Rayonnant.
Decorated English	1300	2d epoch.	
	1350		
Perpendicular	1400	1st epoch.	Tertiary or Gothique Flamboyant.
	1450		
	1500	2d epoch.	
	1550		

Taking this as our basis, the first style to which our attention is directed is the Romanesque, a style of which we have no example in this country.

THE ROMANESQUE STYLE.

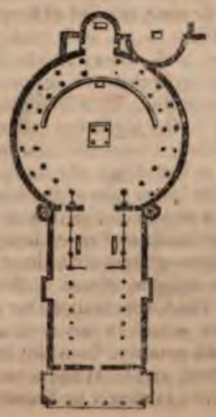
Applying the term of Romanesque style to those monuments imitated more directly from Roman architecture, we find a variety of specimens erected between the fifth and twelfth centuries bearing all the impress of their origin, and throwing much light on the history of the art. It was only about the fifth century after several invasions of the barbarous hordes, that sufficient tranquillity was restored in France to allow of the erection of new edifices, and of the repair of the old ones. The conversion of the Franks under Clovis to Christianity, created a necessity for buildings suitable to the new form of worship, to which the Roman temples were ill adapted. Instead of narrow sanctuaries secured by thick walls, the ceremonies of Christianity required large covered buildings, in which the congregation could participate in the services. It seems that under these circumstances the architects of that period sought for the type of their designs in the ancient synagogues of the Jews, and the civil basilicas of the Greeks and Romans. To the former they were naturally led by tradition and association, while in the latter they found a conveniency of disposition suitable to the extended wants of large communities. Thus were the caves in which the early Christian sought refuge, supplanted by the new edifices which from being built at Constantinople and Rome, served as models to other Christian countries. Hiding from persecution it was only in caves and in the hollows of rocks that the first votaries could worship in peace, and yet even in these places of banishment they had already introduced greater pretension in the disposition. At Montmajour, near Arles, one grotto church is laid out with two parallel naves, while in that fine specimen of a primitive temple at Sutrium, in Etruria, the space formed in the rock is divided into a vestibule, a nave divided by pillars so as to form side aisles, and a sanctuary. With greater liberty of worship more display was aimed at, and rude attempts were made to rival the labours of the past. In these essays it was natural that the relics of Roman art should be referred to as models, and plundered for materials, although as they could neither appropriate Roman genius nor transfer Roman skill, they necessarily fell behind their masters in success. Who can mistake the source, whence the annexed entablature and capital is derived, and many as strong can be adduced. Thus also the details of the order in the porch of the Cathedral at Avignon, the Franks employed not only bricks similar in form to those of the Romans, but used those which they obtained from the destruction of other edifices.

Fig. 1.



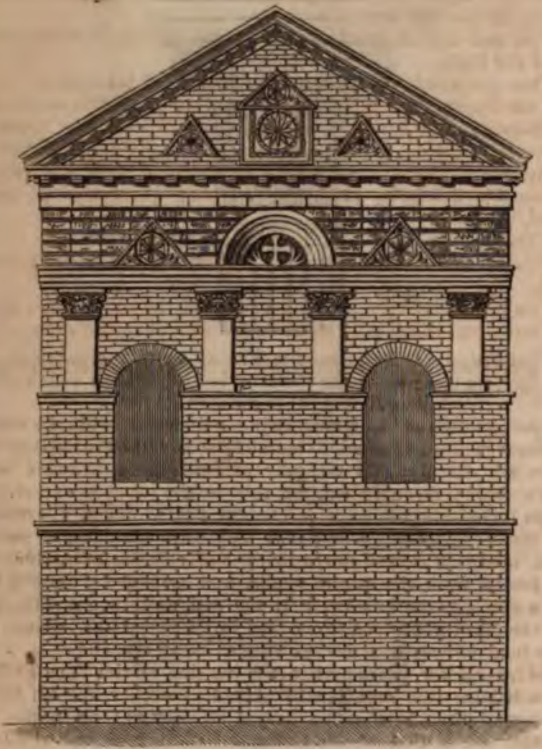
The ground plan of the Romanesque edifices is evidently referable to the sources already alluded to, and we have in Fortunatus, a poet of the sixth century, and Gregory of Tours descriptions of several churches which serve to confirm this to the utmost extent. Such were the primitive basilicas erected in Paris, Tours, Clermont and other cities of Gaul. We find that they were spacious, of an oblong form, divided into several naves by rows of columns of marble, doubtless obtained from the pagan spoils, and arranged parallelly to the lateral walls. At the hemicycle in the end, used as a sanctuary, was placed the altar, in the position called in Vitruvius the tribune, which in Christian edifices was always single, or at one end only, while in those of an earlier period, as in the basilica of the Foro Trajano at Rome, a tribune was occasionally placed at each end. Of the early specimens of the Christian basilica, if we may so term it, one of the best preserved, is that of the Cathedral of Parenzo in Istria, built in the sixth century. Frequently however these buildings were of a circular form, many of which are to be found in Italy, while in France there is St. Germain l'Auxerrois, called St. Germain the Round: several were consecrated by Constantine, both in the east and the west. Occasionally the circular form was combined with square naves, of the kind before described, something in the style of the church of the Holy Sepulchre. The church built by Perpetuus over the tomb of St. Martin, near Tours, was a fine example of this last combination, and the accompanying engraving shows a restoration of the ground plan from the description of Gregory, of Tours.

Fig. 2.



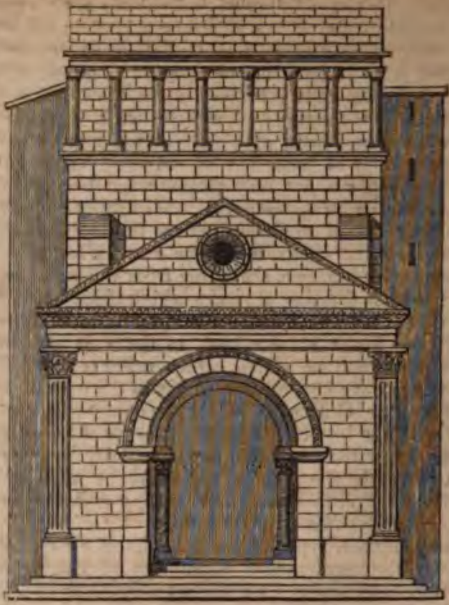
The mode of construction was based on that of the Romans, the buildings being made either of Roman brick or as before observed of bricks of a similar form made at that time. The architects also frequently made use of brick and stone in conjunction, a favourite system with the Romans. This is the case with the Baptistry of Poitiers, and the church of the Basse Œuvre, at Beauvais. Although at first formed very simply, these buildings soon began to be richly decorated with gilt mosaics, splendid marbles, and luxuriant carvings. Stephen of Tournay describes the basilica of St. Genevieve at Paris, built by Clovis, and destroyed by the Normans, as being covered with mosaics both inside and out; and Fortunatus, calls the basilica of St. Germain des Prés, built by Childebert, the gilt house of Germain, being decorated with gilt mosaics, and with a bright metal roof.

Fig. 3.



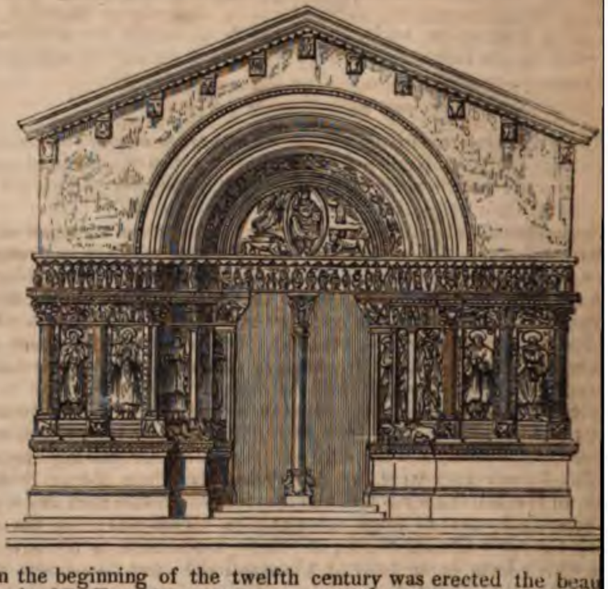
The church of St. John at Poitiers, represented above, is considered as belonging to the sixth or seventh century, and was originally a baptistry, as is proved by the discovery of a great octagon basin in the centre, and used for baptism by immersion. This building has undergone many changes, but the genuine portion is sufficiently distinct to be easily recognized. A pediment of ancient proportions surmounts the façade, and mouldings of simple profile frame it in, and these corresponding to the pitch of the roof, are accompanied by incrustations of a semicircular shape. Large stones, cut in intaglio, and ornamented with rosettes, decorate the tympanum. The horizontal entablature which supports the pediment is complete, consisting of an architrave, frieze and cornice, which last is enriched with modillions. Below the entablature is a band or zone, formed of large stones and bricks placed alternately, in the midst is an arch composed of several concentric circles, projecting over each other; and in the centre of this arch is a Greek cross resting on an architrave, supported by short pilasters with capitals in the ancient style. Two triangles in stone, similar to those in the tympanum, are on the right and left of the arch. Between the pilasters and below their bases are two windows now circular, but which were formerly in the shape of arcades, lighting the interior. A string course divides the lower part of the front into two equal divisions, through which no door was made, as it was opposite to the entrance.

Fig. 4.—Portal of the 11th century, of Our Lady of Gifts, the Cathedr
of Avignon.



The buildings of the south of France belonging to this period wear more of the ancient physiognomy than those elsewhere, a circumstance to be attributed to the neighbourhood of the noble Roman ruins, many of which still exist. The Cathedral of Our Lady of Gifts, at Avignon, has a porch the date of which is not well known, but which may be referred to the eleventh century, from the introduction of the door of the church at the bottom, and from the situation of the steeple, which surmounts it. This porch carries a pediment, of which the pitch is still conformable to ancient tradition; the mouldings of the side corn
have disappeared; in the middle is a circular opening called by
Christian authors an *oculus* or eye. The pediment is supported b
entablature of bad proportions, but ornamented with details servi
imitated from Roman architecture. The entablature rests on
Corinthian columns, attached to the angles of the porch, shown in
first engraving, and so exactly imitating the Roman monuments in
country, as to lead at first view to the belief that they are of pa
origin. In fact the arcade like entry shows a great resemblanc
those of the triumphal arches of Orange and St. Remy. The basen
of the steeple is decorated with a row of columns quite in the Ro
style.

Fig. 5.—Church of St. Trophime, at Arles.



In the beginning of the twelfth century was erected the bea
church of St. Trophimus, at Arles, represented above, and which s
a point of union between the Roman style and that of the middle
proper. According to Gregory of Tours, this church, which in
sixth century was consecrated to St. Stephen, was only named afte
Trophimus in 1152, when the relics of the first bishop of Arles
placed in it. In the fifth century, this cathedral had been enri
with marbles from the theatre of Arles, which Saint Hilary had
for the decoration of Christian places of worship. It is surmou
by a pediment very slightly inclined, and the mouldings with whi

is enriched, like most of the others in different parts of the porch, are still in the Roman style. Several details recall the traditions of the past, but already the representation of singular figures, capitals and bases, decorated with lions and chimeras, showed that the imagination of Christian artists was wandering from the rules laid down by the Greeks. Sacred history, related in sculpture, begins to cover all the zones of the façade, and images banished from the inside of the church take their stand without. In the midst of the tympanum formed by the springing of the arches, is God the Father surrounded by emblems of the Evangelists, above on the lintel are represented the Apostles, on the right of the Almighty the elect, and on the left the damned. Between the columns of marble which decorate the anterior parts of the door, are carved saints and bishops, a resurrection and other religious subjects. It may be observed that the arch already begins to assume something of the pointed shape, which it was afterwards to retain so long. The cloister of the church of St. Trophimus is one of the finest known; the arcades of its porticoes are supported by light columns surmounted with capitals of good style, and all the jutting columns which form the principal divisions of the galleries are decorated with statues of life-size, and with numerous bas reliefs, producing an admirable effect. Though the galleries of the cloister are of the same period as the portal, the other two are of the fifteenth century.

At Vaison, at the foot of Mount Ventoux, at Cavaillon, at Pontoise, at St. Paul-trois-Châteaux, and in many other towns of the south of France, are to be seen churches or chapels, in which it is easy to perceive that in the middle ages was formed a school of architecture, for a long time imbued with the ancient principles. If we add that in the royal church of St. Denis, founded in the fifth century by Saint Genevieve, and at Montmartre, where was a chapel dedicated to St. Denis are to be found marble capitals, decorated with the cross and other Christian emblems, and yet executed in the form and with the character of Roman capitals, it may be believed with good reason that the primitive churches of the Gauls showed like those of Italy, a filiation with Roman art, and that the tradition of classic forms was only lost after a certain number of generations, and through the influence of Byzantine, art imported from the east. At the same time we are able to trace the germs of the subsequent styles, for in Anvergne, Baron Taylor[*] found in a church of the Romanesque era, the arch decorated with the chevron moulding.

HARBOURS OF REFUGE.

Practical Observations on Harbours of Refuge, and on the effect of Back Waters or Sluices, as applied in the Scouring of Harbours.

By H. Barrett.

> "Give harbour room, and public ways extend,
> Let temples worthy of our God ascend,
> Bid the broad arch the dangerous flood restrain,
> The Mole projected break the roaring main,
> Back to its bound the subject sea command,
> And roll obedient rivers through the land."
>
> Cherbourg.

The subject of our harbours having for some time attracted much attention, and the recent appointment of Commissioners to investigate and report upon the state of the harbours on the south-east coast, having given rise to some discussion as to the proper principles which should govern the construction of harbours generally, I am induced to offer the following remarks as the result of my own experience and observation on this subject, continued through many years and in various parts of the world.

In 1826, and again in 1827, I was examined before a committee of the House of Commons on the subject of the then proposed harbour of refuge at Lowestoft, the connexion of the sea with Lake Lothing, and the improvement of the natural *river navigation* from thence to Norwich, for vessels drawing 12 feet water, so as to make that city a port *via* Lowestoft, and avoid the necessity of transhipment at the port into river lighters, as at Yarmouth, through which means Norwich has been for centuries supplied with coals and other sea-borne merchandize.

The following are extracts from the evidence given before the Committee on the occasion I have referred to, viz.

From the evidence of the Engineer.

"My proposition is to carry 12 feet at low water into the Lake, and I have no doubt on the outside it will scour deeper.

Q. You will always have 12 feet into the Lake?

A. Yes.

Q. What will the depths be at high water?

A. 20 feet. A vessel of 16 feet could enter during two thirds of the tide, *i.e.* at two thirds ebb.

Mr. Telford.

Q. Can you form an opinion as to the distance it will be from the shore where the bar will form?

A. There will be no bar—no deposit—next to none.

Q. Will the water from Lake Lothing take it away?

A. Yes; but I say there will be *no bar*, by this operation of the water, *none at all.*

Mr. Barrett.

Q. Do you think the sand carried out of the harbour would be lodged on the flat and form a bar?

A. Yes, and that it would lodge beyond the reach of the scouring water of the Lake.

Q. Then you think that an accumulation would take place?

A. I am decidedly of an opinion that an accumulation would occur, in the shape of a bar across the Harbour, and that at low tides even small vessels could not enter in consequence of the accumulation."

On my second examination before the Committee of the House of Commons, which was in 1827, the following questions and answers occurred, viz.

"*Q.* You have a clear opinion that a bar will be formed?

A. That *is* my opinion, and that the sluicing power will increase the evil.

Q. You have adopted a new hypothesis on the subject of a bar?

A. I have, and differ with all the engineers as to the cause of bars.

[See published evidence on the Norwich and Lowestoft Navigation, in sessions 1826 and 1827.]

The Act of Parliament having been obtained in 1827, the works of the Harbour were proceeded with, and in 1831 the Lake was connected with the sea; the sluices were then applied in order to scour out the newly excavated passage; but the immediate effect after a very few sluicings, was the formation of a *bar* opposite to the newly made entrance, the result being just as I had, in my evidence before the committees, stated it would be; and instead of 12 feet at low tide, and 20 feet at high tide at the entrance, according to the engineers' previous opinion as shown in their evidence, the result was that it became *nearly dry* at low tide, so that no vessels could enter. Such was the injurious consequence of the sluicing water.

In 1832, after the effects of the sluicing had been developed, a remonstrance was addressed by letter to the directors of the Harbour, by pilots and others residing at Lowestoft, in which they said,

"Deeply sensible of the advantages, national as well as local, attainable by the construction of an efficient harbour, at Lowestoft, we cannot but view the present with a feeling of regret, *its entrance encumbered with a shoal or bar.* We understand that the Commissioners for the Public Works are willing to lend £50,000 on mortgage, and we strongly recommend the appointment of an *experienced nautical engineer.*"

From the fatal error in the use of the sluicing waters, added to the mistaken mode of construction adopted, the whole undertaking became a failure, and the entire property, with piers, wharfs, buildings, engines, &c., have been recently submitted to public auction by the loan commissioners as mortgagees for £50,000 advanced by them; but the Harbour and all the property which had cost about £140,000, would not fetch £15,000, and were consequently bought in.

As far back as the year 1823, I published a pamphlet admonishing the public that it was impossible to construct a harbour of refuge on the site and by the method then proposed, and afterwards adopted; the result of this undertaking has fully verified my predictions, which, indeed, were founded on infallible data. Some time prior to that period, and before I developed my opinions on the certain effects of egress or sluicing waters, I had visited and observed upon various harbours in different parts of Europe, viz. St. Petersburgh, Nerve, Revel, Dantzick, Konnigsberg, Copenhagen, Elsineur, Norway, Hamburg, Tonningen, Amsterdam, Rotterdam, Ostend, Brest, Bayonne, Cadiz, Gibraltar, Malta, and on the coast of Africa; also many ports in England, Ireland, and Scotland, Shetland Islands, and the Orkneys.

In none of those places did I find any exception to the thesis which I have adopted relative to the injurious effects of egress, sluicing, or scouring waters, and I venture boldly to assert that in no part of the globe is there any exception, viz.

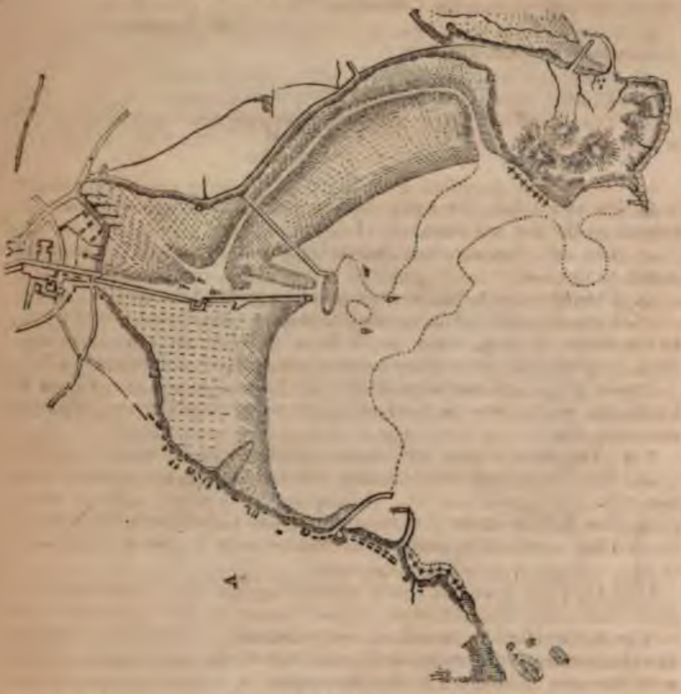
"*That wherever the water passes from the interior into the ocean with sufficient velocity to carry matter in suspension, and to cause a conflict-*

---

[*] Journal, vol. 2, p. 194.

ing action with the waters of the sea, there a shoal or bar is invariably formed, and that the greater the velocity of the egrees water, the larger will be the accumulation of shoal or bar. (See Fig. 1.)

Fig. 1.—Plan of Dublin Bay and Kingstown Harbour.



In various parts of the world, harbours at the entrance of rivers have been entirely blocked up and lost, by the operation of sluicing waters, and whether naturally, or artificially applied, the effects are similar. I may instance the following places, viz.

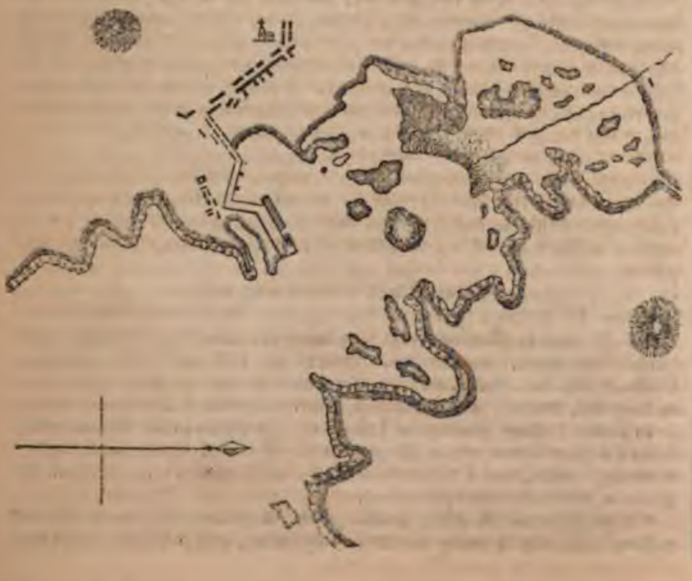
Wisbeach, Yarmouth (its north entrance), Winchelsea, Romney, Lowestoft, before referred to, Alexandria, the mouth of the Po, and of the Nile, and many others which might be enumerated.

The learned and great geologist, Baron Cuvier, states that "all attempts to improve the entrance to harbours by scouring waters have ever proved abortive, and brought science into contempt."

The futility of such attempts the examples here quoted demonstrate

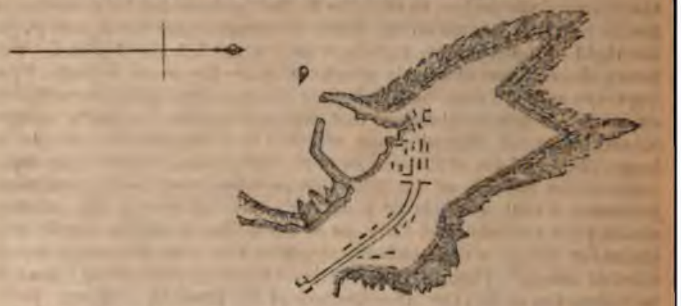
Labelye, who wrote in 1747, said, "*I advise all persons to be on their guard in attempts to construct locks or sluices on coasts, for besides the expence, they would be in danger of losing their harbours.*

Fig. 2.—Plan of Ardglass Harbour naturally formed.



My second proposition is that, "*wherever there is an absence of egress or sluicing waters, or where the water passes into the ocean so as not to convey matter in suspension, and not to cause a conflicting action with the waters of the ocean, there is no bar or shoal, or exterior accumulation*; and this proposition also applies equally to a natural harbour (see Fig. 2.) as it does to one of artificial construction. (See Fig. 3.)

Fig. 3.—Plan of Portrush Harbour, artificially formed.



Among the places I have visited, there are many that exemplify this proposition, the harbours being free from bars, and some of them sufficiently capacious to contain the whole British navy.

I will now refer to the evidence taken before a Committee of the House of Commons in 1836, on Dover Harbour, and on the means suggested by the Engineer for improving that harbour, who, in his evidence, says, "we are putting down pipes; and that is to carry away the *sluicing water*, and render it *more available by increasing its force*. The object has been that which every engineer who has been consulted is desirous to obtain, and it appears to me that *the remedy, although an expensive one, cannot fail to be complete.*"

Mr. Cubitt, (in answer to a question by the committee), said,

"Suppose that these works do not do so much as it is expected, for *successful they must be to a great degree*—"

The attempted improvement has turned out a failure. I will next give a short extract from the evidence of nautical and practical men, who were examined by the same Committee, and the result has shown that their opinions were better founded.

Mr. Hammond, a pilot, speaking of the plans, stated the alteration which had been made had not been effectual.

"*Q*. State your opinion to the Committee on the works now going on.

A. The bar will be more prejudicial and dangerous than it was before. If cleared one tide, it will be filled up the next.

Capt. Boxer, R.N., gave similar evidence, and said, "the works *will be a complete failure.*

The Honourable Captain (now Rear Admiral,) Elliot, gave similar evidence, and said, "*I consider, if the whole of the present plan was completed, the Harbour, as far as regards a Refuge Harbour, would be just as imperfect as it is at this moment.*" *

After reading the above evidence, it must be clear to every candid and reasoning mind, that whatever the right plan may be for the construction and improvement of harbours, that plan has not yet been hit upon by those engineers who have hitherto employed their talents in this department, and as the greatest national interests are involved in the question, and the safety and protection of our great maritime commerce, as, indeed, of our naval force itself, must mainly depend on the efficiency of Harbours, in which ready refuge may be found in time of need, no object can possess a higher claim upon public attention than Harbours of Refuge; on almost every part of our coasts the loss of property and of human lives have become a reflection on our national character. It is a lamentable truth, that while so many schemes of improvement or benevolence are daily attracting the patronage of the people of this kingdom, yet both the enterprize and the humanity of the same people have lain comparatively dormant on this subject, which more than any other affects our character and our interests as a great maritime nation.

In this branch of practical knowledge we are, it is to be regretted, much behind our continental neighbours, and prejudiciously shall we find it so in the event of a war with them.

In the session of 1839 I presented a petition to the House of Commons, praying to be heard by a committee on the subject of bars, and on the mode of constructing Harbours, free of bar or shoal at the entrance, and I was prepared to prove that the want of practical and nautical engineers was the principal cause of failure of the attempts to construct eligible Harbours, or of improving the existing Harbours, and further experience has strengthened this opinion.

---

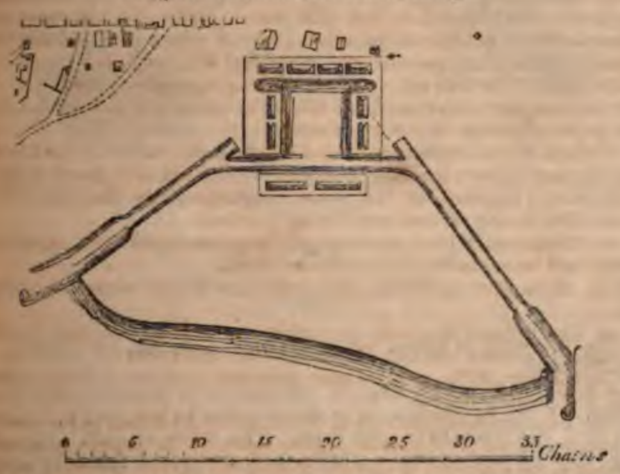
* See the published evidence on Dover Harbour. Session, 1836.

The petition was merely laid on the table, and my earnest desire to engage the attention of Parliament and of the public to a subject so deeply important, was on that occasion disappointed.

I am, however, not discouraged in my hope of ultimate success in the promulgation of my opinions, in which I have now the gratification to find myself countenanced by scientific, practical, and nautical men; and I shall continue to use my zealous exertions in pressing upon the public attention the necessity of full discussion to ascertain, and when ascertained to adopt and pursue, what may prove to be the correct principle of constructing and maintaining Harbours of Refuge, with regard to which I repeat my firm conviction of the *great error*, which cannot be too generally exposed, of the application of *sluicing waters for the purpose of improving the entrance to Harbours*, at best but a *temporary expedient*, and which has never proved a *permanent remedy*.

To the investigation of this subject I would especially, and most earnestly, invite those eminent and humane individuals who are bestowing their wealth, and influence in promoting charities, for the relief of the widow and orphans of shipwrecked mariners, and remind them of the old adage, "that prevention is better than cure;" that it is better to *save the lives of sailors*, than to stand by and see them *perish*, and then provide for their families who may be left destitute, and that Harbours of Refuge would be the means of preventing many of those calamities, no one can entertain a doubt; and that such Harbours can be successfully constructed in various places on our coast, where they are so much required, I will venture with confidence to affirm. (See Fig. 4.)

Fig. 4.—Plan for a Harbour of Refuge.



A Committee of the House of Commons was appointed in the session of 1836, for inquiring into the causes of shipwrecks, and they reported,

"That three millions of property, and one thousand human lives, are annually lost by shipwrecks on our coasts; and that the *want of efficient Harbours of Refuge* was one of the principal causes of these calamities.

The Committee of the General Ship Owners' Society, in their report, May, 1837, referring to the above report, stated that there is no Harbour of Refuge (that can be so called) from *the Firth of Forth to the Thames*,* and that the numerous casualties, unfortunately occurring in the navigation of the seas surrounding the British coast, naturally awaken the feelings of humanity; and that the loss of property from the River Tyne (only), amounted *annually* to £151,222, and of human lives in the same time, 170.

In 1836 there were 110 vessels stranded and wrecked on the Lowestoft and Yarmouth coast, and 197 vessels lost anchors and cables, many others sustained much damage. These losses (alone) may be estimated at £120,000, all of which falls on the ship owner or underwriter; but the incidental expences of a voyage, Harbour dues, &c., together with the ship-owners' profits, are paid by the *consumers* of the cargoes in the shape of freight.

The above sum would be sufficient to construct an eligible Harbour of Refuge on that coast; and the £3,000,000 annually lost by shipwreck, is adequate to construct Harbours on various parts of the coast, where they are so much required.

Under the impression, therefore, that Harbours of Refuge can be constructed, and ought to be constructed, I would invite the active assistance of all who can lend a hand in so good a work, for the attainment of which, I shall continue to devote my best exertions, myself *an old sailor*, I would, on behalf of sailors and their dependents, and for their safety, invite in so sacred a cause, the co-operation of the benevolent, the patriot, and the Christian.

H. Barrett.

London, 8th April, 1840.

TABLE OF ARCHITECTS.

[A NOTE TO THE EDITOR.]

Sir—I am quite horrified at finding that you have made me commit homicide—I might say infanticide, sending Schinkel out of the world, as soon as he had come into it. I don't say your printer's devil, but your devil of a printer, has *diabolically* and with malice prepense omitted the word "*born*" attached to the name, consequently it now appears that I fancy Schinkel died in the year 1781, whereas he is not only alive and well, but doing well as may be seen by your "Literary Intelligence" at page 130; and I hope he will not appear in any obituary or necrology for many years to come—not until 1881, at which time he will be only one year older than Clerisseau was at the time of his death; the latter architect having attained a degree of longevity far exceeding that of any other whose name occurs in the table.

In a paragraph of page 132, some computations are made from the table relative to length of life among architects, but it is not stated how many lived to upwards of 80. Among the latter was Gondouin, who, though he did not attain to a very remarkable longevity, is remarkable for having ventured to commit matrimony with a girl of seventeen, at the venerable age of seventy-seven!

I have not yet done, for I must protest against the appearance of a gentleman called Jean Radolphe, whom I never invited to my *table*, and who must therefore be turned out as an intruder. Perhaps he may be an acquaintance of your *diabolical*; and that worthy may be able to give some account of him. The first Jean appears, in fact, to be a mere nobody,—and so also does Gerstenburgh of whom it should have been recorded that he was professor of Civil Architecture at Jeva, and author of several publications, but principally on surveying, and, therefore, has but little right to make his appearance among the company he does.

And now feel relieved: you may, therefore, present my hearty, if not good wishes to your dial, and believe me, &c.

W. H. L.

P.S.—I have just seen by a foreign journal that Albertolli, whose name stands at the end of the table died last November, in his 98th year, consequently may be quoted as an instance of longevity. I also now perceive that Jean Radolphe, should have been attached to the name of Perronet, in the next line.

Sir—Among the Architects of the 18th century, a list of eleven was given in your last number; the Signor Albertolli was mentioned, the author not being sure whether he still existed. I received, a few weeks since, a letter dated 27th January last from his nephew and son-in-law the Signor Ferdinando Albertolli, professor of architectural ornament in the academy of Breva, and honorary and corresponding member of the Royal Institute of British Architects. In this letter is the following paragraph:—"To our great grief we lost, on the 15th November last, our venerable parent at the age of 97 years, three months and 21 days, from a cold in the chest. His best work is the Villa Melzi on the lake of Como, and he was the author of several publications on ornament. Our academy are now raising a subscription in order to erect a handsome monument to his memory."

I regret that the author of the list, to which I allude, did not give the authorities, upon which it is founded; an indispensable accompaniment, to any document upon which reliance is to be placed, and a loss to those who wish to study the matter beyond the bare enumeration of names.

I am, Sir, very faithfully yours,

April, 1840. Thos. L. Donaldson.

Sir—In your number of April, you have favoured your readers with a list of the Architects who have died in the 18th and 19th centuries, in which you have omitted the name of Charles Beazley, who died January 6th, 1829. He was a pupil of Sir Robert Taylor, and consequently the fellow student of Nash, Craig, Pilkington, Byfield, and Cockerill (the last of whom, as well as Craig and Byfield, are likewise omitted). Mr. Charles Beazley was the architect of the Goldsmiths' company, and a district surveyor nearly 50 years ago. He built a great number of gentlemen's seats, besides many buildings in London and its vicinity, and was likewise the architect of Faversham Church in Kent, which has been so generally admired.

---

* Nor is there from the Thames to the Isle of Wight.

Feeling that it is perhaps impossible for your collector to know the names of all the deceased architects, I trust that you will attribute this letter to the sole motive by which it is dictated, namely, to add such information as may enable you to correct your list should you republish it.

I remain, Your most obedient Servant,

29, *Soho Square, April* 3, 1840. SAMUEL BEAZLEY.

We have received another communication from Mr. Webb, for which we are obliged, containing the names of some architects, which were omitted in the table; we shall, at some future opportunity, avail ourselves of this communication, together with others, and publish an additional table. Editor C. E. and A. Journal.

TEACHERS OF CIVIL ENGINEERING, ARCHITECTURE, &c!!

SIR—As your highly useful journal is devoted to the advancement of the professions you advocate, allow me to draw your attention to what I consider to be an evil of the greatest magnitude, and one which has done more to lower the profession, and to bring it into disrepute, than anything else that I am acquainted with. I allude to the proceedings of a certain class of persons, styling themselves "Architects and Surveyors," or "Civil Engineers," who disgrace the profession they claim by pretending to teach it *in a few lessons*. Such men should be held up to universal scorn and contempt, for they have ruined the profession while filling their own pockets, by a process little better than swindling. I will explain the manner in which they go to work. They first put a specious advertisement in the newspaper, headed "Offices for Surveying, Architecture, and Civil Engineering," and go on to state that *a few lessons* are all that is required to enable a person to practise on his own account!! Some deluded individual is sure to be allured by this specious advertisement, for unfortunately, wherever there are dupes, there are sure to be knaves to take advantage of them.

Such persons, (the dupes,) find to their cost, that the business of an Architect, or Surveyor, or Civil Engineer, is not *quite so easily* acquired as they were at first induced to imagine by their *disinterested* instructor: instead of *a few lessons*, therefore, occupying a few weeks only, they are persuaded to go on with the farce for a few months, or until the master-hand thinks they will bear plucking no longer. He then lets them go, assuring them that they are *quite competent* to undertake *any survey whatever*, whether for canal, railway, or turnpike-road, and, if asked, furnishes them with testimonials to that effect, The newl-y fledged surveyor, or whatever he may choose to call himself, delighted with his newly and so easily acquired profession, hastens to put his skill to the test, and for this purpose, perhaps, takes an extensive parish to survey at a low rate, one, perhaps, that has to obtain the commissioners' seal, and for which he will therefore not be paid until it is completed to their satisfaction, and to that of Capt. Dawson, no easy person to please. He commences his work with confidence, but, after a short time becomes involved in a labrynth of perplexity and error, from which he cannot extricate himself; he, therefore, hastens back to his mentor to relate his misfortunes, and is persuaded by the latter to take a *few more lessons*, or perhaps is induced to employ him to survey the parish, for which he takes care to charge the "honorary" surveyor, about five times as much as he is himself to receive for the parish when completed. If endowed with a sufficient stock of gullibility and cash, the latter accedes, and after expending perhaps a much larger sum than he would have done, if he had placed himself with a respectable surveyor in a regular manner, he at length acquires a sufficient knowledge of the business to enable him to get on by himself without making many more blunders. In many cases, however, the aspirant is disheartened with his first failure, and declines the honour of being further taken in by his preceptor.

This is the way, Sir, in which the pockets of the unwary are picked, and the profession of the surveyor brought into disrepute; and the same remarks apply also to that of architecture, which our *professor* professes also to teach in a few lessons!!

Really, the barefaced impudence of some men exceeds all bounds, and yet we see the advertisements of these *highly respectable* members of the profession almost daily in the newspapers, a sure sign that they find it to answer their purpose, which is to fill their pockets at the expense of others.

I think, that you would be really conferring a benefit upon the profession generally, and on the rising generation in particular, by drawing attention to the tricks of these advertising quacks, who are in general, persons of no kind of reputation or ability, and who are therefore quite unqualified to give instructions in the business they profess. By pointing out also the fallacy and utter absurdity of a person endeavouring to acquire *in a few lessons*, a profession in which a man's *whole life* is barely sufficient to enable him to acquire all the minutiæ of his art, and in which there is always *something new* to be learnt, you may be the means of preventing the inexperienced from falling into such an error, and into the clutches of our advertising *professors*. The profession is already overstocked with persons regularly educated, and perfectly competent to practise it, but it is too bad that they should be continually brought into collision with, and made to suffer for the ignorance and blunders of others calling themselves "Architects and Surveyors," or "Civil Engineers," on the strength of a few lessons received from parties nearly as ignorant as themselves, and who are no more qualified to practice the professions they pretend to teach, than I am qualified to fulfil the duties of Lord High Chancellor.

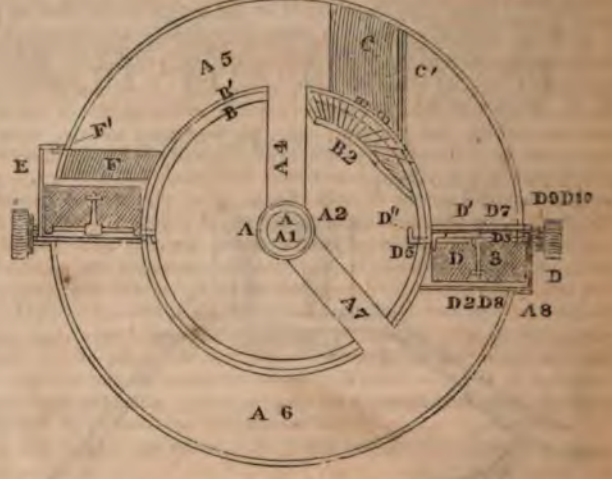
I have the honor to be, Sir,

London, April 17, 1840. ONE WHO HAS SUFFERED.

[We do not wonder that parties can be induced to think that civil engineering can be taught in a college, when there are those who believe that it can be required in a few lessons. What is to become of the hundreds of accomplished professors who are to be manufactured wholesale at the Gordon College!

MR. MOORE'S PATENT ROTARY ENGINE.

Fig. 1.



The following is a brief outline of this invention, taken from the specification.

A 5, A 6 is a hollow ring, or cylinder, with two pair of folding doors, D 3 and F, which open in the direction D, D 2, and F, F 1, and fall back into boxes to receive them. The doors of each pair open together by means of tooth wheels, and are closed again by coiled springs behind them, and afterwards pressed closely together by the elastic force of the steam, when the piston C has passed them. A, A 1 is a hollow axle, through one arm of which, at A, the steam enters, and passing through the tube A 4, just behind the piston, fills the space left between the piston C, and the folding doors F, next behind it. By its pressure on C, and confinement against the said folding doors, the piston (which is firmly connected with all the interior part A, A 2, &c.) and the said interior part revolve together in the fixed ring cylinder, A 5, A 6, in the direction C C'. As the piston C approaches the doors D 3, the beveled part B 2, acting on the ketch D 5, gradually opens the folding doors, which, after the piston has passed, close again by means of the coiled springs, and are kept tight by the steam issuing through A 4. Through A 7, A 1, all the steam or air in advance of the piston passes off, and leaves the front side of the piston with no more than the common pressure of the atmosphere, as in all other engines, to oppose the piston.

This is the principle of the machine, and of its action, but a variety of contrivances are introduced—shown by other diagrams we have not thought it needful to insert—for the purpose of meeting and overcoming any difficulties in the way, and of rendering the machine more perfect.—*Railway Magazine.*

Electro-Galvanism.—At a lecture delivered at the Boston Mechanics' Institute, on Friday the 13th ult., by Mr. H. R. Gilson, the curator, he exhibited a most ingenious and important application of electro-magnetism to practical purposes, by which he is enabled to take the casts requisite for sterotyping in copper. They are at present made in plaster of Paris, and are seldom absolutely perfect; but by this novel application of science to the arts, stereotype plates may be produced as perfect and sharp as the type from which they are taken.

GENERAL THEORY OF THE STEAM ENGINE.

By Aristides A. Mornay, Esq.

No. VI.

On the Action of the Steam in the Cylinder of a Steam Engine,
(Continued.)

We shall first consider the most simple case, namely, that of a low pressure condensing engine without expansion, and with the ordinary slide valve, as the action of this valve is more simple than any other for calculation.

On the subject of the slides we have to observe, that, although their motion is gradual and as slow as it can be, yet there is no loss of effect arising from this circumstance. We should not have thought it necessary to mention this fact here, as we stated it cursorily in our last paper, but we have since seen a paragraph in Tredgold's Treatise on the Steam Engine, where he asserts the contrary. This paragraph is at page 204, and runs thus:

"When valves, cocks, or sliders are to be moved to admit steam to a steam-engine, the motion should be as quick as circumstances will permit, so that the passages may be wholly opened or wholly closed at the proper time with the least delay; for it may be easily shown that a considerable loss of effect arises from valves opening or shutting with a slow motion."

Now the slide, when it has no travel, takes one half of the duration of the stroke to open, and the other half to shut the ports; and, as the eccentric is placed a quarter of a revolution in advance of the crank, the ports are full open when the piston is at the middle of the stroke, and completely closed at each end. If, however, we can show that the aperture of the steam port is always proportional to the velocity of the piston, it will be proved that the steam will follow the piston with the same pressure from the beginning to the end of the stroke. This will, however, only apply to the steam port as regards the disadvantage of the slow motion of the slide; for the more rapidly the waste steam can be made to pass into the condenser, the greater effect will obviously be obtained from the steam.* At the beginning of the stroke of the piston, then, the slide is in the middle of its stroke; the piston has no velocity, and the steam-port is completely shut, but just ready to open, and its aperture increases in the ratio of the distance travelled by the slide from its present position in the middle of its stroke. Now that distance is equal to $e \sin a$, when the shaft has described the angle a, e being the eccentricity or distance of the centre of the eccentric from that of the shaft. In the same time the piston will have acquired the velocity $v \sin a$, if v is its velocity in the middle of the stroke. These two quantities evidently increase always in the same ratio, therefore the orifice of the steam-port is always sufficiently large to admit steam of the same elasticity as at the middle of the stroke of the piston, supposing no waste space to require filling with steam at the beginning of each stroke, and this is effected before the piston has described a sensible portion of its stroke, the steam having a much greater tendency to flow into nearly a vacuum than into steam of very little less than its own pressure.

In order to allow for the filling of the waste space with steam, we will suppose the slide, instead of having no lead, to have just so much as will allow that space to be filled with steam of the same elasticity as that in the steam-pipe, by the time the steam has arrived at the end of the cylinder, and is ready to begin its stroke, the aperture of the port being at the same time enlarged so much, that in the middle of the stroke of the piston it should be sufficient to allow the steam to follow the piston with the required elasticity. But, since this necessary lead of the slide and enlargement of the port are, as will be hereafter proved, excessively small, we shall omit to take them into consideration, merely assuming the effect for the sake of which these alterations were supposed, namely, that the waste space is already filled with steam of the same elastic force as that in the steam-pipe at the moment the piston commences its stroke.

Suppose now the piston in the middle of the stroke, in which case the steam port will be full open, and let the elastic force of the steam in the steam passages $=$ P, that of the steam in the cylinder $= p$, the ratio of the area of the piston to that of the steam port $= m$, and V $=$ the mean velocity of the piston in feet per minute. Let it be required to determine p when all the other quantities are known.

In order to solve this problem, we have to find, *first*, the velocity of the steam through the port necessary to enable it, when expanded to the elastic force p, which it assumes in the cylinder, to follow the piston with the velocity $\frac{\pi V}{2}$ which the piston has attained in the middle of the stroke; *secondly*, the height of a column of steam of the elasticity P, which would give it that velocity, and *lastly*, the pressure of that column, which will be equal to the loss of pressure which the steam suffers in entering the cylinder.

In the first place, the velocity of the steam through the port, if it retained its density, would be $\frac{m \pi V}{2}$; but, since we suppose a loss of pressure, we must also assume a diminution of density; and, if we call v' and v, the relative volume of the steam in the steam passages and in the cylinder respectively, the velocity through the port will be $\frac{v' m \pi V}{2 v}$. The height due to this velocity is,

$$h = \frac{v'^2 m^2 \pi^2 V^2}{28{,}800\, g\, v^2},$$

and this is the height of the column of which the pressure is to be determined. This would evidently be known if we knew the height of the column whose weight is equivalent to the total elastic force P, which we shall therefore now endeavour to ascertain.

Let p and v be the elastic force and relative volume of steam at the temperature t, and p' and v' those of steam at the temperature t'; also let H be the height of a column of the former, whose weight is equivalent to its pressure p, and H′ the height of a column of the latter whose weight is equivalent to its pressure p'. It is evident that we must have

$$\frac{H'}{H} = \frac{P' v'}{P v}.$$

But we have also

$$\frac{P'}{P} = \frac{v\,(t' + 448)}{v'\,(t + 448)} = \frac{v\,T'}{v'\,T},$$

which value being substituted in the preceding equation, it becomes

$$\frac{H'}{H} = \frac{T'}{T}.$$

When $t = 212$, H is the height of the column of atmospheric steam equivalent to its elastic force, and H′ that of the column of steam at any other temperature t' equivalent to its elastic force p'. Assuming the density of water to be 1700 times that of atmospheric steam, and the pressure of the atmosphere to be equal to the weight of a column of water 34 feet high, the value of H will be 57800 feet, and we shall have

$$H' = \frac{57800}{660}\, T',$$

or, reducing the coefficient and dropping the accents,

$$H = 87{\cdot}57576\, T.$$

Since the value of P is supposed to be known, we can find that of T by referring to a table, so that we may consider H as already determined, and therefore make use of it in the determination of the loss of pressure P $- p$, which the steam suffers in entering the cylinder.

As the two columns H and h have the same density, their pressures are evidently proportional to their altitudes, therefore

$$\frac{P - p}{P} = \frac{h}{H},$$

whence

$$P - p = \frac{v'^2 m^2 \pi^2 V^2 P}{28800\, g\, v^2 H},$$

or, substituting for the constants π^2 and g their values, and for H its value 87·57576 T, as found above,

$$P - p = {\cdot}00000012156\, \frac{v'^2 m^2 V^2}{v^2 T}\, P. \qquad (a)$$

We may be allowed to presume that the difference between v' and v in all cases which occur in practice is so trifling that the ratio $\frac{v'^2}{v^2}$ may, without any sensible error, be regarded as equal to unity, which will reduce the preceding equation to the following simpler one,

$$P - p = {\cdot}00000012156\, \frac{m^2 V^2}{T}\, P. \qquad (b.)$$

---

* In condensing engines, working with low pressure steam, the resistance of the waste steam is usually considered as equal to the pressure in the condenser; we shall show in a future paper that where the slide valve is used with no lead, the pressure of the waste steam on the piston is much greater than in the condenser during a considerable portion of the stroke.

To show numerically by how much the pressure p of the steam in the cylinder may fall short of P, which is its pressure in the steam passages, we shall apply these formulæ to one or two examples, when we shall also show that the error introduced by neglecting the difference between v' and v does not amount to so much as one hundredth part of a pound, whether the steam be used at a high or low pressure, provided the area of the steam passages be not excessively small, nor the velocity of the piston very great.

As a first example let $P = 14{\cdot}71$, $m = 25$, and $V = 240$. The temperature of the steam in the passages is in this case 212 degrees, which gives $T = 660$, and $v' = 1700$.

Having substituted these values, we find

$$P - p = {\cdot}00663\, P = {\cdot}0975 \text{ lb.},$$

whence

$$p = {\cdot}99337\, P = 14{\cdot}6125 \text{ lbs.}$$

The relative volume of steam of this elastic force is 1711, which makes $\frac{v'^2}{v^2} = {\cdot}9872$, and if we multiply the above value of $P - p$ by this fraction, we shall obtain

$$P - p = {\cdot}0963 \text{ lb.},$$

which gives

$$p = 14{\cdot}6137 \text{ lbs.},$$

which differs from the former value by no more than ·0012 lbs., which is a negligeable quantity.

As an example of excessively high pressure steam, let $P = 130{\cdot}93$, and m and V the same as in the former example. In this case we have $T = 798$ and $v' = 230{\cdot}9$.

From formula (b) we obtain

$$P - p = {\cdot}005484\, P = {\cdot}718 \text{ lb.}$$

whence

$$p = 130{\cdot}212 \text{ lbs.}$$

The relative volume of steam of this elastic force is 2321, so that $\frac{v'^2}{v^2} = {\cdot}9897$, and, multiplying by this fraction the value of $- p$ just obtained, the latter becomes

$$P - p = {\cdot}711 \text{ lbs.},$$

whence

$$p = 130{\cdot}219 \text{ lbs.}$$

The error introduced by neglecting the fraction $\frac{v'^2}{v^2}$ is therefore also in this case too small to be worth taking account of, so that we may always content ourselves with formula (b), when we wish to ascertain the loss of pressure which the steam suffers in passing through the steam port into the cylinder of a steam engine.

On referring to equation (b), it will be seen that the loss of pressure which the steam suffers in passing through the port into the cylinder varies *directly* as the square of the velocity of the piston, and as the square of the ratio of the area of the piston to that of the steam port, and *inversely* as the number of degrees by which the temperature of the steam in the steam passages exceeds —448 degrees Fahr., which shows that, the higher the pressure of the steam used, the less is the comparative loss in passing through the port, and, the greater the velocity of the piston, the larger the steam port must be in the same proportion, that the loss of pressure may be the same.

We assumed a rather considerable value for V in the above calculations, in order to show more satisfactorily how trifling is the error which can be committed in deducing the elastic force of the steam in the cylinder from that in the steam passages. By making $V = 210$ feet per minute, which is the speed usually given to the piston of an engine, instead of 240, which we assumed above, the value of $P - p$ will be reduced in the ratio of 210^2 to 240^2, or 49 to 64. When therefore the area of the steam port is one 25th part of that of the piston, and the mean velocity of the piston is about 210 feet per minute, we may assume, as an average for low pressure engines,

$$P - p = {\cdot}005\, P,$$

or

$$p = {\cdot}995\, P;$$

and for high pressure engines,

$$P - p = {\cdot}0046\, P,$$

or

$$p = {\cdot}9954\, P.$$

It is a very good plan to fix a steam guage on to the slide box, or steam pipe very near the cylinder, as that dispenses with the calculation of the loss of elastic force experienced by the steam during its passage through the steam pipe, before it arrives at the slide box.

When speaking of the lead of the slide necessary to allow the waste space at the end of the cylinder to be filled with steam before the beginning of the stroke of the piston, we said we should prove it to be excessively small. The calculation of the exact lead required for that purpose is very long and difficult, involving integrals of a very complicated nature; but it will answer our purpose equally well to prove it for a greater lead than necessary, for it will then be proved à fortiori for the necessary lead.

Let P be the elastic force and D the density of the steam in the steam pipe, and let H = the height of a column of the same steam whose weight is equivalent to its pressure. Also let p be the elastic force, and δ the density of the steam in the waste space when the port is open to a certain degree, α the area of the orifice at that moment, v the velocity of the steam through it, and q the volume of steam of the density D which has passed through the port, and let d be the density of the steam in the condenser, and consequently also in the waste space before the port has begun to open. In the case of non-condensing engines d is equal to the density of atmospheric steam, or 1. Also let c be the contents of the waste space, A the area of the piston, L the length of the stroke, and $\frac{1}{n}$ the ratio of the area of the steam port to that of the piston.

The height of the column of steam equivalent to the pressure $P - p$, to which the flowing of the steam through the port is due, is equal to $H\left(1 - \frac{p}{P}\right)$, the velocity will therefore be equal to

$$v = \sqrt{2\, g\, H\left(1 - \frac{p}{P}\right)}.$$

But this formula would lead to very complicated calculations, as we have already observed, for which reason we shall substitute the fraction $\frac{\delta}{D}$ for $\frac{p}{P}$, which will render the case less favourable; for the former being greater than the latter, the factor $\left(1 - \frac{\delta}{D}\right)$ is less than $\left(1 - \frac{p}{P}\right)$; wherefore also the value of v will be less after the substitution than before, and consequently the time required to raise the pressure of the steam in the waste space to the maximum which it attains in the cylinder will appear greater than it really is. If therefore we can prove this to be exceedingly short, it will be demonstrated à fortiori for the true time. We shall therefore assume, in place of the above equation

$$v = \sqrt{2\, g\, H}\sqrt{1 - \frac{\delta}{D}},$$

or

$$v = \sqrt{\frac{2\, g\, H}{D}}\sqrt{D - \delta}. \qquad (1.)$$

We have also between the variable quantities q and δ the following relation

$$c\, \delta = q\, D;$$

whence

$$q = \frac{c}{D}\, \delta,$$

And, by differentiation,

$$\text{dif. } q = \frac{c}{D}\, \text{dif. } \delta.$$

But we have also

$$\text{dif. } q = \alpha\, v\, \text{dif. } t,$$

where dif. t is the infinitely small space of time during which the infinitely small quantity of steam dif. q of the density D passes through the orifice α. These two equations, having their first members equal, give

$$\frac{c}{D}\, \text{dif. } \delta = \alpha\, v\, \text{dif. } t. \qquad (2.)$$

Let $b\, r$ represent the area of the steam port when full open, b being its constant length and r the greatest width to which it is opened by the eccentric, which is equal to the eccentricity of the latter; we shall then have, calling θ the angle described by the eccentric from the moment when the port began to open till its aperture had become equal to α,

$$\alpha = b\,r \sin\theta; \qquad (3.)$$

whence we obtain by differentiation

$$\text{dif. }\alpha = b\,r\cos\theta\ \text{dif. }\theta,$$

or

$$\text{dif. }\theta = \frac{\text{dif. }\alpha}{b\,r\cos\theta}.$$

But equation (3) gives

$$b\,r\cos\theta = \sqrt{b^2\,r^2 - \alpha^2},$$

which, being substituted, makes

$$\text{dif. }\theta = \frac{\text{dif. }\alpha}{\sqrt{b^2\,r^2 - \alpha^2}}.$$

And, if we call τ the duration of a single stroke of the piston, or half a revolution of the shaft, we shall also have

$$t = \frac{\theta}{\pi}\,\tau;$$

whence by differentiation

$$\text{dif. }t = \frac{\tau}{\pi}\ \text{dif. }\theta,$$

which becomes by substituting the value of dif. θ just found

$$\text{dif. }t = \frac{\tau}{\pi\,(b^2\,r^2 - \alpha^2)^{\frac{1}{2}}}\ \text{dif. }\alpha.$$

Substituting this value, as well as that of v given by equation (1), in equation (2), this latter becomes

$$\frac{\text{dif. }\delta}{(\mathrm{D} - \delta)^{\frac{1}{2}}} = \frac{\tau\sqrt{2\,g\,\mathrm{H\,D}}}{c\,\pi}\,\frac{\alpha\ \text{dif. }\alpha}{(b^2\,r^2 - \alpha^2)^{\frac{1}{2}}}. \qquad (4).$$

The greatest value which δ can acquire, being equal to the maximum density of the steam in the cylinder during the stroke of the piston, cannot be quite equal to D, but will not fall far short of it. On the other hand it is evident that, if we assume D as the maximum value of δ, the hypothesis will be unfavourable to our demonstration; we are therefore permitted to make it; and as the minimum value of δ is equal to d, we must integrate the first member of preceding equation between the limits $\delta = \mathrm{D}$ and $\delta = d$. The limits of the value of α in the second number are $\alpha = a$, the aperture of the port when δ has attianed its greatest value, and $\alpha = o$. We must therefore have

$$\int_d^{\mathrm{D}} \frac{\text{dif. }\delta}{(\mathrm{D}-\delta)^{\frac{1}{2}}} = \frac{\tau\sqrt{2g\,\mathrm{H\,D}}}{c\,\pi}\int_o^a \frac{\alpha\ \text{dif. }\alpha}{(b^2 r^2 - \alpha^2)^{\frac{1}{2}}}. \qquad (5.)$$

In the first integral let $\mathrm{D} - \delta = x$; then dif. $\delta = -$ dif. x, and

$$\int_d^{\mathrm{D}} \frac{\text{dif. }\delta}{(\mathrm{D}-\delta)^{\frac{1}{2}}} = -\int_o^{\mathrm{D}-d} x^{-\frac{1}{2}}\ \text{dif. }x.$$

$$= -2\,(\mathrm{D} - d)^{\frac{1}{2}}.$$

In the second integral make

$$b^2\,r^2 - \alpha^2 = z.$$

By differentiation we obtain

$$\alpha\ \text{dif. }\alpha = -\tfrac{1}{2}\ \text{dif. }z.$$

We have, therefore,

$$\int^a \frac{\alpha\ \text{dif. }\alpha}{(b^2\,r^2 - \alpha^2)^{\frac{1}{2}}} = -\int_{b^2 r^2 - a^2}^{b^2 r^2} \frac{1}{2}\,z^{-\frac{1}{2}}\ \text{dif. }z.$$

$$= -\left[b\,r - (b^2 r^2 - a^2)^{\frac{1}{2}}\right].$$

Substituting these values of the integrals in equation (5), we obtain

$$2\,(\mathrm{D} - d)^{\frac{1}{2}} = \frac{\tau\sqrt{2\,g\,\mathrm{H\,D}}}{c\,\tau}\left[b\,r - (b^2 r^2 - a^2)^{\frac{1}{2}}\right],$$

and, substituting for a its value given by equation (3),

$$2\,(\mathrm{D} - d)^{\frac{1}{2}} = \frac{\tau\sqrt{2g\,\mathrm{H\,D}}}{c\,\pi}\left[b\,r - b\,r\,(1 - \text{im. }\theta^2)^{\frac{1}{2}}\right]$$

$$= \frac{b\,r\,\tau\sqrt{2\,g\,\mathrm{H\,D}}}{c\,\pi}\ \text{sim. }\theta;$$

whence we deduce

$$\text{sinv. }\theta = \frac{2\,c\,\pi\sqrt{\mathrm{D} - d}}{b\,r\,\tau\sqrt{2\,g\,\mathrm{H\,D}}};$$

or, putting for $b\,r$, which is the area of the steam port when full open, its value $\frac{\mathrm{A}}{n}$,

$$\text{sinv. }\theta = \frac{2\,n\,c\,\pi\sqrt{\mathrm{D} - d}}{\tau\,\mathrm{A}\sqrt{2\,g\,\mathrm{H\,D}}}.$$

Now $\frac{\mathrm{L}\ \text{sinv. }\theta}{2}$ expresses the distance passed through by the piston while the shaft describes the angle θ round its axis, and consequently during the time the waste space is filling with steam, therefore, if we call l that distance, and $\frac{1}{\mathrm{S}}$ the ratio of the waste space c to the contents of the cylinder between the limits of the stroke, we shall have $c = \frac{\mathrm{A\,L}}{\mathrm{S}}$, and

$$l = \frac{n\,\pi\,\mathrm{L}^2\sqrt{\mathrm{D} - d}}{\mathrm{S}\,\tau\sqrt{2\,g\,\mathrm{H\,D}}},$$

or

$$\frac{l}{\mathrm{L}} = \frac{n\,\pi\,\mathrm{L}\sqrt{\mathrm{D} - d}}{\mathrm{S}\,\tau\sqrt{2\,g\,\mathrm{H\,D}}} = \frac{n\,\pi\,\mathrm{L}\sqrt{1 - \frac{d}{\mathrm{D}}}}{\mathrm{S}\,\tau\sqrt{2\,g\,\mathrm{H}}}$$

or, since the densities are inversely as their relative volumes,

$$\frac{l}{\mathrm{L}} = \frac{n\,\pi\,\mathrm{L}\sqrt{1 - \frac{\mathrm{V}}{v}}}{\mathrm{S}\,\tau\sqrt{2\,g\,\mathrm{H}}} \qquad (6.)$$

As an example for low pressure steam, let $\mathrm{L} = 5$, $n = 25$, $s = 20$, $\mathrm{P} = 17{\cdot}78$ lbs., whence $\mathrm{V} = 1427$, $\mathrm{T} = 670$ and $\mathrm{H} = 58675{\cdot}7576$; let the temperature of the condenser be 110 degrees, in which case $\mathrm{V} = 14952$; and, if we suppose the piston to move through 200 feet in a minute, $\tau = 1{\cdot}5$ second. We have besides $\pi = 3{\cdot}1416$ and $g = 32{\cdot}19$.

Substituting these values in the second member of equation (6), we obtain

$$\frac{l}{\mathrm{L}} = \frac{3{\cdot}1416 \times 25 \times 5\sqrt{1 - \frac{1427}{14952}}}{1{\cdot}5 \times 20\sqrt{64{\cdot}38 \times 58675{\cdot}7576}} = {\cdot}0032.$$

In the example chosen the value of l would thus be less than one-fifth of an inch, and it will be remembered that this value is too great in consequence of our having substituted the ratio $\frac{\delta}{\mathrm{D}}$ for $\frac{p}{\mathrm{P}}$.

As an example for high pressure steam, we will take the data from locomotive engines, and assume $\mathrm{L} = 1{\cdot}5$, $n = 15$, $s = 20$, $\mathrm{P} = 77{\cdot}95$; whence $\mathrm{V} = 369{\cdot}5$, $\mathrm{T} = 760$, and $\mathrm{H} = 66557{\cdot}576$; also $v = 1700$; and, if we suppose the piston to move through 360 feet in a minute, $\tau = {\cdot}25$ second.

Substituting these values, we find

$$\frac{l}{\mathrm{L}} = \frac{3{\cdot}1416 \times 25 \times 1{\cdot}5\sqrt{1 - \frac{369{\cdot}5}{1700}}}{{\cdot}25 \times 20\sqrt{64{\cdot}38 \times 66557{\cdot}576}} = {\cdot}01007.$$

In this example, therefore, the value of l is but a trifle more than ·18 of an inch, or less than $\frac{3}{4}$ of the lead of $\frac{1}{4}$ of an inch usually allowed in locomotives.

The ratio $\frac{l}{\mathrm{L}}$ also expresses the proportion of the whole area of the steam port by which its aperture is diminished at the moment the piston reaches the middle of its stroke, and as this quantity is, as the wo above examples show, exceedingly small, it is unnecessary to make any allowance for it.

A FEW REMARKS ON THE CONSTRUCTION OF OBLIQUE ARCHES, AND ON SOME RECENT WORKS ON THAT SUBJECT.

Until within the last few years, the construction of oblique bridges has been but little understood, from a doubt as to their stability, and from the difficulty of their construction, they were regarded to a certain degree with distrust, and the engineer would only have recourse to them when the circumstances of the case were imperative; the superior scientific acquirements of the engineers of the present day, however, the assistance of various books on the subject, and the great experience obtained in this species of construction, by the demand occasioned for them in the large railway undertakings which have lately occupied so much of the public attention, have contributed materially to remove the veil of mystery which formerly hung over them; the doubt which was at one time entertained of their stability is removed, the oblique bridge is now generally adopted, and the only point remaining to be cleared up is, as to the best method of working the parts together, so as to obtain the desideratum of engineering, viz., stability, economy, and beauty of appearance.

Since the commencement of the London and Birmingham Railway, four authors have written on the construction of oblique bridges, Mr. Fox, Mr. Hart, Mr. Buck, and Mr. Nicholson. It should be observed, with reference to the two latter, that Mr. Buck's work appeared before the third part of Mr. Nicholson's was published. The announcement of a work on this subject, by a person whose reputation as an author, stood so high as that of Peter Nicholson, naturally gave rise, in the practical world, to the hope that the difficulties which had heretofore attended the constructing of oblique bridges would, with his powerful assistance, be much reduced, if not entirely removed, but that our most reasonable anticipations are sometimes doomed to disappointment, was never more signally shown than in this instance. A few quotations will be sufficient to give a specimen of the errors and inconsistencies which, we regret to say, characterize this book. Mr. Nicholson says in his preface, "In this undertaking, the general reader is not supposed to be much acquainted with scientific researches," and he accordingly goes on, in the introduction, to inform him that a right angle contains ninety degrees, that 60 minutes make a degree, and that "a number having a small zero or cypher placed over the right hand shoulder of the figure or last figure, shows this number to be as many degrees as the figure or figures express." At page xx of the introduction, he says, "If a spiral surface be cut by a plane obliquely to the axis of the cylinder, the section will be a curve of contrary flexure, and if the spiral surface be cut by another plane passing along the axis, perpendicular to the first plane, the section, which is a straight line, will intersect the curve of contrary flexure at the point of retrogression." The first of these paragraphs appears intended for a person who has only learnt to read and write, while the second, it must be admitted, seems little adapted to the understanding of those who are unacquainted with scientific researches.

In Section IV, page xxiii, which treats of the trihedral, he states that "If a trihedral be cut by a plane perpendicular to one of its oblique edges, the section shall be a right angle." Now a trihedral may have all three of its edges oblique, or one obtuse and two oblique edges, or one right and two oblique edges, and the above assertion only holds good with regard to the latter; with such a glaring error as this among the definitions on which his trihedral system is founded, it is of course unnecessary to examine it further. One part of the subject in which Mr. Nicholson has been very unfortunate, is relative to the sections of spiral surfaces; of this we will only give one instance here, as we shall have occasion to return to this subject. He says, page 24, "the transverse section is, therefore, the only section of the spiral surface which is a straight line." Whereas, in introduction, page XIX, we find, "If a spiral surface be cut by a plane, either perpendicular to or passing along the axis, the section will be a straight line.

The history and theory of oblique bridges is, by some system of arrangement peculiar to the author, placed after the problem for constructing the templets for working arch stones, and is followed by a practical method for obtaining the templets. This history, so curiously placed, appears to be introduced chiefly for the opportunity thereby afforded the author of making his own strictures on other works; but in his anxiety to detract from the merits of all authors but himself on this subject, he has again fallen into so many errors, as to leave no doubt of his being but superficially acquainted with the subject on which he writes.

Mr. Fox has asserted, in common with other writers on the oblique arch, that, "when the soffit is developed, the edge which formed the face of the arch gives a true spiral curve." Upon this Mr. N. remarks, "It must, however, be observed, that the edge of the develloped semi-ellipse is neither a spiral line nor the projection of a spiral line." In this remark Mr. Nicholson is decidedly wrong, for it is easy to demonstrate that the curve above mentioned is the projection of a true spiral, whose radius is equal to half the obliquity of the arch, and whose length is equal to the semicircumference of the cylinder on which the arch is assumed to be built. With reference to Mr. Fox having stated that the joints in the face are curves, Mr. N. says, "if they had been curves, the curvature would have been so small, that the joint lines would not have varied sensibly from straight lines. The true curvature of the joint could not, therefore, have been expressed in lines." Now if Mr. Nicholson had ever had occasion to put his rules into practice in a bridge of considerable obliquity, he would have found that the face joints near the springing are not only curves, but very perceptible ones. There is, moreover, nothing impossible in constructing the curves formed by the face joints, it is nearly as simple as the construction of the spiral itself; but this is a part of the subject on which Mr. Nicholson is throughout unfortunate.

Mr. Buck's Essay on the Oblique Bridge next falls under our author's scrutiny; that it should receive his entire disapproval, is not perhaps surprising. Mr. Buck has had the advantage of Mr. Nicholson in being able, while engaged on the London and Birmingham and other railways, to put his rules into practice, and prove them to be right before he laid them before the public; he has, for the same reason, been able to select the useful parts, and present them to the reader unencumbered by the superfluous and weary waste of words through which Mr. Nicholson's readers are doomed to wander. Relative to this work Mr. Nicholson proceeds to say, "The formula $co = (r+c) \cot \theta \tan B$ is due to Mr. Buck; it gives the distance below the centre to the point of convergence, into which all the joints in the elevation of the arch meet in the axis minor, supposing that the joints are straight lines, which they are not exactly." This having reference to the section of the spiral surface, no wonder Mr. Nicholson is again unfortunate. Mr. Buck does not wish his readers to turn the curves into straight lines, which peculiar operation, if properly conducted, is to cause the straight lines to converge to a point. He simply gives the point to which the chords of the said curves so converge, and the formula for finding this point is not all that is due to Mr. Buck, but the discovery of the fact that they do converge to a point, and the uses to which this discovery can be applied in facilitating the construction of the bridge.

Mr. Nicholson next complains that Mr. Buck has given, besides his general formula for finding the point of convergence, another formula which happens to be more convenient when making the necessary calculations for the segmental arch. He concludes at once that the results of these formulæ must differ, and puts forth his assertion to the world as if the book were in error. His concluding paragraph relative to Mr. Buck's book is, "One thing which we consider defective in Buck's Essay on Oblique Arches is, that his intentions are not enunciated under regular heads, so as to call the attention of the reader; he gives no reason for his rules, nor does he show the principles upon which his formulæ depend. The height of the point o, Fig 7, will depend upon the breadth of the beds."

The first part of this remark we will leave Mr. Nicholson to settle with his conscience in the best way he can. As regards the second part, we would ask what is the E in Mr. Buck's formula if it is not the breadth of the beds or the thickness of the arch, which is one and the same thing? Mr. Nicholson ought, in justice, to ascertain that an error really exists, before he implies that such is the case. That he has not long been acquainted with the fact of the chords of the joints in the face converging to a point below the axis of the cylinder, is evident from his book on stone cutting, in which the joints are drawn at right angles to the curve, and that he was unaware of the utility of knowing this point is equally evident, or he would never have given the laborious and complicated construction for finding the joints in the face, beginning at page 17.

Mr. Nicholson gives rules for what he terms two kinds of oblique bridges, namely, those in which the joints of the stones are planes, and those in which they are spiral surfaces; these rules are so jumbled up together, that the reader is at a loss to know to which of the two species of bridges they refer. At page 15 there is a problem, "To find the curved bevels for cutting the quoin beads of an oblique arch." The reader being unable to learn from the heading of the problem whether it relates to square or spiral joints, naturally proceeds to wade through it, with the hope that it may afford some means of ascertaining this fact, but here he soon becomes lost in a labyrinth. You are told to divide the arc A B C into as many equal parts as the ring stones are in number, and through the points of division draw $b\,k$, $c\,i$, $d\,j$, &c., perpendicular, to the curve A D E. A B C and A D E being two different curves in two different directions, there is evidently a great omission somewhere, which, however, we might forgive if his meaning could be discovered, but it cannot. A little further on he tells you to join *a m*, *b m*, *c m*, &c., but where the point *m* is to be placed, Mr. Nicholson has quite forgotten to say.

Page 10, referring, as is stated at the head of the page, to plate 24, is another example in which, from the type being completely at variance with the plate, we are left quite in the dark as to what the author wishes to communicate.

The practical part of this work, if, indeed, any part may be so called, is scarcely less defective than that of which we have already spoken; the direction for dividing the face of the arch into stones of unequal thickness is unworkmanlike and unsightly, and where brick-work is used, the joints must necessarily be larger on one side than on the other.

On the whole it must be admitted that the book is far from being worthy of the great reputation Mr. Nicholson has hitherto justly acquired; it has the appearance of being got up by his journeymen, and signed with his name without a sufficiently careful revision. But we have said enough, though, in closing the book, we cannot but express a wish that, before he had sought the mote in his brother's eye, he had removed the beam from his own.

Manchester. W. H. B.
March 26, 1840.

MARINE ENGINES.

Employment of the expansive principle to its full extent in Marine Engines, with a saving of half the fuel.

Sir—In my remarks in your Journal of last month I dwelt at some length on the advantages to be derived from the employment of the Cornish double beat valve in marine engines, especially the facility which such afford of working the steam expansively. But it may be asked why all this talk of working expansively where there is little or nothing to expand? I would answer this question by another: why adopt a good plan by halves? take the Cornish boilers also, or a suitable modification of them, and raising the steam to 35 lbs. effective, carry out the principle of expansion to its full extent; this would at once reduce the consumption of coal one half, and so double the range of our steam navigation. On such a startling proposition as this being mooted, the question naturally suggests itself, how has this so long escaped the first men of the day? That I shall not attempt to answer; it is sufficient that it has escaped them, and a very slight examination of the matter will make this evident.

Thus taking the horse power at 33,000 lbs. lifted one foot per minute with a consumption of 8 lb. of coal per hour, and this is below the average consumption, we get a duty of 23,000,000 (though 20,000,000 would be nearer the mark, especially in steam boats).

If any be disposed to assert that this is overstated as regards the Great Western and British Queen, as these vessels are said not to consume above six or seven pounds per horse power per hour, I answer, the Queen's engines are 500 horse power at 15 strokes per minute, or the piston travelling through 220 feet per minute, now the pressure of steam, &c. remaining the same, the power exerted by the engine is exactly as the space through which the piston travels; but 12 strokes per minute is nearly the average number the engines make, as appears by her log; this reduces her power in the ratio of 15 to 12, and increasing the consumption of fuel per horse power in an equal ratio, makes the six or seven pounds nominally consumed equal to 8 or 9.

Whereas many of the Cornish double acting crank engines used for stamping ores, the most trying work an engine can possibly be subjected to, and where there is greatest loss by friction, are doing a *duty* of 50, 56, and even 60,000,000, as appears from the authenticated reports of the engineers.

Although this will not be doubted by any one who has had the opportunity of seeing the engines at work, it may suit some to doubt and even to deny the truth of these reports; so they did those of the pumping engines doing a 70 or 80,000,000 *duty*; but as 90, and even 100,000,000 is now being done under their eyes, what credence can such men expect for any statement they may in future make.

Having had occasion to visit Cornwall some three years ago on business, immediately after having completed the engines of a large vessel now on the London and Dublin station, the easy valves, the cool engine room, and almost smouldering fires of the Cornish engines, as contrasted with the stiff and heavy slides, the suffocating heat of the engine room, and roaring furnaces I had just left, attracted my particular attention; and though possessing at that time no data beyond the published reports of the engineers, I saw enough to convince me of their immense superiority, and at once set about considering how the same plan could be carried out in marine engines, a point which I hope to be now able to make clear, and the objections to which I shall endeavour to deal with in detail.

The first is the increased danger of explosion or collapse supposed to be occasioned by the great density of steam.

The second is the additional strength required in the engines to withstand steam of such density when first admitted into the cylinders.

The third is the increased weight of the boilers, and the extent of flue surface required for their successful application.

The first objection, the increased danger, I shall begin by denying "in toto," nay, it appears to me that there is absolutely increased safety, for the following reasons:

Setting aside the increased weight, &c., one boiler can be made quite as capable of supporting a pressure of 35 lbs. as another is of supporting 3 lbs.; the safety valves would have much less tendency to stick fast under the higher pressure, and their becoming a little stiff, or two or three pounds overloaded, would not be of the slightest consequence on a boiler calculated for a pressure of 35 lbs., though it would have a very dangerous tendency on one calculated for 3 lbs.

But the great argument for increased safety is this: it is an established fact that with boilers of the usual construction, nine-tenths of the steam boat accidents occurs through collapse of the overheated flues, much more than from any excessive pressure of steam in the boiler; nor is this to be wondered at if we consider how the fires are urged. Now with the Cornish boilers and a proper system of expansion, the same work can be done with half the coal, and if we consume only half the coal on the same or a greater extent of fire bar and flue surface in a given time, then it follows clearly that we have a fire of only one-half the intensity, and the risk of collapse from overheated flues diminished in like proportion. But if these arguments are insufficient, then the following fact is greatly in their favour, viz., that as few if not fewer accidents occur in Cornwall where such boilers are in universal use, than in any part of the kingdom where steam power to a like extent is used; and if it be further true, as I have heard stated both in Cornwall and elsewhere, that many of the Cornish engineers will engage to keep up the boilers for ever, for the annual sum of 5 or 6 per cent on their original cost,* such an argument appears to me, as it will to most practical men, to be at once perfect and conclusive.

I now come to the increased strength required in the engines, and this on examination will appear trifling. To commence then with the paddle-wheels as they remain of the same size, and are driven at the same speed, no alteration is required in them, and of course the same remark will apply to the paddle-shafts through which the power is transmitted. These being subjected to no increased strain as the average effective pressure upon the piston which takes place when the piston is half stroke, &c., and the crank at its point of greatest torsion, is the same as in a common engine. The intermediate shaft alone with its cranks, in which the crank pins are *fast*, requires additional strength, and as this shaft is only about one-sixth the length of the two paddle shafts, and the strength of a shaft increases as the cube of its diameter, the increased weight will be trifling: next there is the top frame that carries this shaft, and the bottom frame supporting the gudgeons and columns, the strength of both must be increased, and it is as the square of their depth; next comes the piston rod, this will do as before, the piston rod of a large engine being equal to 20 times the strain it is ever subjected to: the same remark will apply to the malleable iron columns supporting the top frame, as each of them is usually made of the same strength as the piston rod.

The piston must be strengthened, but the cylinder will do as before, as it is strengthened at the extremes where the greatest pressure of the steam is by its flanges, and in ordinary cases we are under the necessity of making it much stronger then necessary to ensure a sound casting, and also to support the framing attached to it; besides a cylinder of three-fourths the capacity is sufficient for the same power, so here we are positive gainers in two most important points, strength and space. The gudgeons of the cylinder of double the strength will not be stronger nor heavier than the main centres of the beam engine of the ordinary construction must necessarily be.

The points then which require increased strength are, the intermediate shaft and gudgeons, the top and bottom supporting frames, and the piston. The increased weight from this cause would not exceed 6 or 8 per cent. beyond that of the same description of engine at the ordinary pressure, and after taking this into account, the total decrease, by adopting the vibrating cylinder, would be at least 25 per cent.

I now come to the question of increased weight in the boilers, and this I shall be able to show is not nearly so great as may at first be supposed.

---

* Perhaps some of your readers can affirm or contradict this.

It will scarcely be disputed that the same thickness of plate in cylinders 6 feet diameter, the size of the exterior cylinder of the Cornish boiler, will bear a water pressure at least 3 times greater than if arranged in the usual form of a steam boat boiler; or that the former of 5-16th thickness would bear without flinching a proof pressure of 60 or 70 lbs. to the square inch, while the latter would give evident signs of weakness at 20, although ever so well stayed. If then it be considered perfectly safe to work steam of 6 or 7 lbs. pressure in a boiler which would give evident signs of weakness under a pressure of 20 lbs., surely it is equally safe to work steam of 30 or 35 lbs. in a cylinder of 6 feet diameter, and ½ inch thick, which would bear without the slightest signs of weakness 120 lbs. on the square inch, boilers of this size and thickness being usually worked to 40, 45, and even 50 lbs. per square inch. Then 4 feet diameter, and 7-16ths thickness will be ample for the internal cylinder, and to make security doubly secure, let a strong angle iron be rivetted round the internal cylinder at distances of about 2 feet apart, this would keep the cylinder or arch perfect, and so prevent the possibility of a collapse, with but trifling addition to the weight of the boilers.

Now taking equal extent of common and Cornish boilers, the former taking all stays, &c. into account, will barely average 3-8ths in thickness, while the latter with its internal tube of 18 inch diameter, and 5-16ths thickness, would average about ½ inch. This makes their respactive weights at 3 to 4, but in order to the successful application of slow combustion we require addition flue surface, so take 3 to 5 as the ratio of the weight of common and Cornish engines and water for the same power, the extra space required for the boilers being much more than compensated, by the small space occupied by the vibrating engine.

But to go more minutely into the matter, the weight of a Cornish boiler and water of the size and thickness named, and 35 feet in length, is = 24 tons, exposing a surface 938 feet: eight such boilers might be easily set in the space allowed for the Queen's boilers, now 8 × 24 = 192 tons, as the weight of the boilers, and allowing 50 tons for setting and clothing, we have 192 + 50 = 242 tons, total weight of the boilers and setting, &c.; 938 × 8 = 7504 ÷ 500 = 15 feet surface per horse power, being one-half more than theusual allowance without increasing the weight of the boiler at all, or occupying more space in the vessel.

But allowing that we have increased the weight of the boilers in the ratio of 3·5, let us take the British Queen as the subject of comparison.

The total weight of her engines and boilers is 500 tons, and of this 220 may go in round numbers for boilers and water, and 3 : 5 : : 220 : 366, and 500 — 220 + 366 gives 664—and less 64 tons being the decreased weight of the vibrating engine = 600 tons, as the weight of her engines and water on the Cornish plan.

The account would then stand thus, on the present plan,

Engines and boilers - - - - -	500 tons
20 days fuel - - - - - -	750
Total - -	1250
On the Cornish plan,	
Engines and boilers - - - - -	600
20 days fuel - - - - - -	375
Total - -	975

Showing a capacity for 285 tons more cargo, and a saving of 375 tons of coal.

Though some may consider these figures as exaggerated without being able to assign any reason to themselves or others, save that the plan is impossible. Those who have examined the subject will assuredly blame me for not having gone far enough; and there is another class of well meaning men among engineers and others, who have imbibed such a reverence for the name of Watt, that they almost consider any deviation from the plans he followed, or improvements upon the state in which he left the steam engine, to be an insult to his memory, and a deduction from his fair fame; but my admiration of Watt is as great as any man's can be; I am proud of him as a countryman, and honour him as a great man, and so have endeavoured to add a stone to the monument he has raised, by carrying out a principle which in his third patent of 1782, he distinctly propounded, and of the advantage of which that great man seems to have been fully aware, though he lived not to see it carried into effect.

If then I am born out in these statements, and to disprove the main point, the great increase of duty by expansive working is altogether impossible; and the others I think I have succeeded in making tolerably clear, though on some points as the weight of the present boilers and water of the British Queen, I may have made some slight mistake, not amounting to a few tons either way, having assumed it from comparison with others, and not stated it from actual knowledge, yet on the other hand I have underrated the saving of fuel, and allowed quite enough for the increased weight of the boilers, as there is less due to the great extent of surface than is supposed, the expansion being the point where the power is gained; and however the proposition of adopting steam of increased density may be cavilled at, to the principle of expansive working and slow combustion we must come at last, and by adopting them to their full extent, which I think I have shown to be equally safe and perfectly practical. The Cape of Good Hope is as much within our reach as New York now is, and a speedy and sure passage open to our Indian and Australian empires.

Such then being the case, are we content to allow our preconceived ideas to supersede our better judgment, and go on loading our vessels with unnecessary coal, and thus uselessly consuming our most valuable mineral—limit at the same time the range of our steam navigation, and the civilization of the world at large; or do our engineers mean to allow that they cannot make a boiler safe under a pressure of 35 lb., or that one of the thickness and diameter that I have proposed would not be perfectly safe under that pressure. If they allow neither of these propositions, then the sooner the subject is seriously taken up the better, as every boat now fitting with the usual beam or side lever engines, (and many of the splendid mail packets are being thus fitted), is incapable of being afterwards altered, so as to work expansively, as though the boilers may be altered, the beams, &c. would never stand the increased pressure.

Before concluding, perhaps I may be allowed to correct an omission in my last paper. It is a favourite remark of naval men, "get as extended a hold of the vessel as possible." Now it has often struck me, not only in those vessels I have myself been engaged in, but in every one I have had the opportunity of seeing, that this very reasonable remark is not only not complied with, but that the power is positively brought to bear on the wrong place. Thus no attempt that I have seen has been made to lay hold of the vessel fore and aft in a line with the centre of the paddle shaft, but the framing is stayed sideways, or at best slightly supported by the most contiguous deck beams, and the horizontal strain of the propelling power acting at the bearings of the shaft, the engine frame is thus used as a lever to wrench the under frame of the vessel as it were asunder, and an action is thus created tending materially to weaken the vessel and increase the unpleasant vibration, to remedy this defect, and at the same time to prevent the framing and joints of the engine from breaking, uncommonly heavy bed plates have been resorted to; those on board the British Queen amounting at least to 23 tons; now without entering into a discussion on the point, what I propose is this, let a strong flat bar of wrought iron be carried fore and aft opposite each engine, gradually tapering away, and running in towards either side of the vessel, being at the same time securely bolted through ten or twelve of the deck beams, on the end of this next the engine, let there be a strong joint and a similar one on the engine frame joined by a strong connecting rod, this would allow sufficient play, and at the same time, if I may use the expression, give the porter a hold of his load by the right place.

To conclude, if it be considered that I have not gone sufficiently into detail completely to prove every point I have advanced, my answer is, I have considerably underrated the gain, and overrated the loss, thus rendering minute calculation of strength and weight uncalled for; besides such would have been of no value to any one not intimately acquainted with the subject, and practical men can examine it for themselves.

My object has been to keep the main points of the argument in view, and to make it intelligible to all classes of your readers, and in this I hope I have succeeded, and should you or any of your readers be able to furnish me with the exact weight of the boilers* of the British Queen, and the space they occupy, with any further particulars, I will in a future number enter more minutely into the subject, and illustrate by a few sketches my ideas of how the boilers on the Cornish plan should be set and clothed, and where the extent of surface I have spoken of is obtained; having no doubt that I shall be able to establish every point that I have advanced, bearing on the increased safety and economy of the plan proposed, and at no distant period see it carried into successful operation on a scale commensurate with the importance of the undertaking, and the vital influence which such an improvement would have on our political and commercial relation with all parts of the world.

Pimlico, April 4, 1840. A. S.

---

* The modification of Cornish boilers I propose to adopt has no *external* flues.

RAMBLES BY PHILOMUSÆUS.—No. 6.

THE SOANEAN MUSEUM.

The Soanean Museum is again open for the few months and days which its managers think necessary to afford the public. Three months in the year, and two days per week, are in these days thought enough—we wonder the trustees do not think of charging a shilling, it would be carrying out the *rococo* style completely. Why not take immediate steps for throwing it open? Take up the carpets, apply to the legislature for funds to enlarge the establishment, make the museum worthy of the nation, and the trustees will do honour to themselves and to the memory of the founder. They have, in Mr. Bailey, a talented and well-intentioned curator, with one only fault, that he is disposed to regard an establishment worthy of the public, as only to be conducted for the use of artists,

> "Who, born for the universe, narrowed his mind,
> And to party gave up what was meant for mankind."

Let Mr. Bailey, if he places any value upon the promotion of public instruction, urge the trustees to do their duty.

This year a catalogue has been produced, which, as a first attempt, is of course rather scanty in size, but we are bound to say that the matter which is given is highly creditable to the exertions of the curator. It beats the National Gallery affair hollow, and is superior to the antiquarian portion of the British Museum catalogue. Why is there not a catalogue at the East India Museum? We have only one objection, and that is to the price; we think that three pence would have been rather nearer the value than a shilling; it does much honour to Mr. Bailey; however, there are copies left on the tables for the public to consult, besides the more extensive catalogue *raisonné* of Sir John Soane, so that the officers are acquitted of the slightest intention of jobbing or keeping back information, although they may have erred in a matter of judgment. Indeed, the wish to give information, and the courtesy with which it is imparted, seem, from the example of the superiors, to inspire the lowest officers of the museum, and it were to be wished that, in other establishments, the same spirit prevailed among the attendants.

The list of trustees given in the catalogue is far from inspiring confidence in any one who knows anything of them; there is only one man, indeed, who can be regarded as an active friend to public improvement, for as to the others, they are many of them notorious sticklers for acknowledged abuses. The sooner the museum is put under more active and responsible management the better. While the present parties doze over their duties, the place will continue to be a knicknackery instead of a national institution, and Sir John Soane's weeds will be allowed to usurp the place of his laurels. What we require is a proper classification, sufficient space, and facility of access for students and the public.

Sir John Soane has left the place, like his own head, with all kinds of queer corners in it; but irrespective of his arrangements, we shall proceed to notice, under their several heads, some of the principal objects.

The picture gallery, by means of *moveable planes*, has, crammed into the small space of 13 ft. 8 in. in length, 12 ft. 4 in. in breadth, and 19 ft. 6 in. in heigth, as many works, according to the book, as would cover a gallery of the same height, 45 ft. long and 20 feet broad. Besides the works in these rooms, are others dispersed through the Museum, so that in all there are about fifty paintings and forty drawings, besides statues and bas reliefs in numbers. These works ought to be removed from the museum or sufficient accommodation provided for them, as they are much too valuable to be sacrificed in the present holes and corners. The collection of the English school is very fine, containing 37 paintings and 25 drawings by our first artists. Among these are 12 Hogarths, which cost nearly 2,500*l*. the Rake's Progress and the Election; the Snake in the Grass by Sir Joshua Reynolds; a Jackson, 4 Howards besides the Ceilings, a Danby, a Bourgeois, a Fuessli, a Bird, a Ward, a Durno, an Eastlake, 3 of Jones, a Hilton, a Flaxman, 3 Stothards, 3 Corboulds, 2 Calcotts, 2 Daniels, 2 Turners. Of foreign masters there are specimens by Raffaelle, 4 by Canaletti (and the *chef d'œuvre* from Fonthill), by Rubens, Paul Veronese, Watteau, Ruysdael (3), Ostade and Zuccherelli.

The collection of sculpture, marbles, casts and models both ancient and modern, is fine. The specimens of Flaxman's works are above 40 in number, and ought to be brought forward so as to form a collection of the works of this great artist, who has done so much for our progress at home, and our architectural reputation abroad. Among them are figures and bas-reliefs of Piety, Charity, Truth, Winged Victory, Tenderness, Resignation, Hope, The Adoration, Joseph's Dream, Adam and Eve, Michael and Satan, a Grecian Feast, the Shield of Achilles, Mercury and Pandora, the Golden and Silver Ages, Cupid, Psyche, Britannia, Marquis of Hastings, Warren Hastings, Lord Mansfield, Pitt, Michael Angelo, Raffaelle, Reynolds, Kemble, &c. The works of Banks are about ten; they include the sleeping girl, St. Peter in Prison, the Dying Patriot, Achilles, and Caractacus. There are also specimens by Michael Angelo, John de Bologna, Donatello, Rysbrack, Westmacott, Chantrey, Gibson, Baily, Rossi, &c.

The architectural department includes drawings, models of buildings, and of details, and wants only arrangement to form a collection in the highest degree valuable. Among the drawings are all those of Sir John Soane's works, and others by Piranesi, Zucchi, Bibiena, Campanella, Clerisseau, Pannini, Labello, Asprucci, Sir James Thornhill, Sir W. Chambers, Kent, Sir Robert Smirke, &c. There are busts of the following architects: Palladio, Inigo Jones, Sir C. Wren, Sir W. Chambers, Dance, and Sir J. Soane.

The antiquities and curiosities might be made to form a museum as useful to artists as the new rooms in the Louvre at Paris, to which the artist and the pattern-drawer might resort with the greatest advantage. The purchase of the Belzoni vase was a terrible satire on the mode in which our museums are conducted, and a worthy pendant of the Ægina marbles affair; Sir John Soane said that he was but too glad to give the two thousand pounds the British Museum refused. Among the miscellaneous objects may be mentioned, Sir Robert Walpole's tables, Napoleon's sword and portrait, the Napoleon medals, Peter the Great's pistol, Tippoo Saib's chairs, Queen Mary's table, &c.

CANDIDUS'S NOTE-BOOK.

FASCICULUS XV.

> "I must have liberty
> Withal, as large a charter as the winds,
> To blow on whom I please."

I. The clever and pleasant writer, "Nimrod in France," (Colburn's New Monthly), says in regard to French Houses, "There is one essential in the construction of them, of which I cannot speak too highly, and that is their mortar. It appears almost to equal in hardness the similar preparation of lime and sand mixed with water, for which the Romans were so celebrated, and which for its powers of cement and its durability, we have not been able to equal by our system of admixture. Certainly the French mortar may justly be called *cement;* and it is well that it can boast of this superiority, inasmuch as French bricks are most inferior to ours, from want of skill and care in the burning of them. French houses, however, generally speaking, are miserably defective in their plans, both for convenience and comfort, nor does there appear to be a desire to improve their structure. A heavy tax on windows and doors would be a blessing on the country—at all events as far as it would relate to lumbago, rheumatism, catarrh, coughs, and sundry other pains and penalties which human flesh is heir to."

Perhaps, too, a heavy tax upon supernumerary windows would be a benefit in this country,—at any rate it would be so architecturally, since scarcely anything is more inimical to nobleness of aspect, to solidity of appearance, and to repose, or more productive of insignificance than windows crowded together in such a manner that the piers between them are not so wide as the apertures themselves. This is an exceedingly common fault, the ordinary practice in London house-building being to put three windows where two would be sufficient. The consequence is that one side of a room is nearly all window, with no space for other furniture than chairs or mere knick-knack tables; so exposed to the sun in summer time, that it is necessary to exclude it by blinds, and occasioning a cheerless uncomfortable look in cold and bad weather. While as additional agremens, may be mentioned, that unless the street be a very wide one, your front rooms are thus fully exposed to the full fire of your neighbour's eyes, of "the amiable people over the way" who most disinterestedly interest themselves in reconnoitring your *menage* as far as they can penetrate into it; and who, of course, busy themselves in imagining what they do not see.

II. 'Marry in haste and repent at leisure,' is a proverb that mutatis mutandis applies to architecture,—both to architects themselves, and their employers, many designs being adopted without due examination, the consequence of which is that their faults and defects escape notice, until it is either too late or too expensive to correct them. Nay in some cases the faults are so exceedingly glaring that it is wonderful how the designs could pass muster at all,—or how any one, calling himself architect, could make up his mind to pass off upon his employers the barbarously crude ideas we so frequently behold. Happy is it for such people that their employers are not only ignoramusses, but most tasteless ignoramusses into the bargain.—And that tribe among professionalists are therefore quite right in exclaiming against amateurs and amateurship, since the more the public become enlightened, the worse must it fare with them. They ought to pray for blockheadly gullible patrons—persons who look upon architecture as an unfathomable mystery, which the initiated alone have any right to understand.

III. Where ignorance is bliss—but I need not repeat the rest of that very hackneyed quotation,—therefore observe that I have sometimes almost envied the blessedness of ignorance, as I lately did while walking with a friend from the country, in the Regent's Park, whose rows of paltry mock palaces called forth expressions of admiration from him, that, I presume, were perfectly sincere. To the shade of that miserable architectural sinner John Nash, they must have been a requiem, but to me, to have to listen to the praises of that consummation of paltriness, was hardly endurable. And yet my companion was a person of tolerably good taste in other respects, and what is generally understood by "a well educated person," though imposed upon by such arrant architectural balderdash as those same terraces are. It seems to me that most persons have not the slightest shame whatever in displaying the grossest stupidity relative to every thing connected with architecture; and why is it so, except because the notion has been instilled into them—would that it were flogged out of them!—that it is for architects, and them alone, to pretend to understand its principles, these latter being, by some curious jumble of ideas, supposed to be entirely *mechanical*, notwithstanding that architecture itself has got the name of one of the fine arts. I once fell in with a gentleman, who was hardly less than a Solomon in his own conceit and pretensions, and who nevertheless staggered me by the *candour* with which he confessed he never could comprehend the ground plan or section of a building, or understand what they meant! Notwithstanding which degree of gentlemanly or genteel and blissful ignorance of low mechanical matters, my Solomon could, I found, speak glibly and boldly enough 'by look,' passing his opinion upon buildings, of which it was very evident, although he did not care to make such confession, that he understood no more than he did of sections and ground plans. There are, I am afraid, too many Solomons of his kind among our enlightened public."

IV. In an article entitled "The British School of Architecture," Blackwood's Magazine, August 1836, it said that the fourteen columns of the intended Doric structure on the Calton Hill, are "even now the most imposing objects of the kind in Britain: they impress strangers more than any modern edifice in the island, and if the structure be completed by the munificence of donations or bequests, on the same scale of primœval magnificence, it will give to the Scottish metropolis a distinction beyond what any capital in Europe can boast." The scheme for that national monument is also warmly advocated in the New Edinburgh Review, April, 1823. It seems, however, that the Scotch are too poor to prosecute the undertaking any further, else no doubt their prudence would urge them to complete as speedily as possible a building that could hardly fail to attract a great many visitors to their capital. Nevertheless some of them have so much money that they make the most desperate efforts in order to get rid of it, for instance, that remarkably silly Lord, Lord Eglintoun, who had he given towards this work the thousands he expended upon his tomfoolery of a tournament, would have secured to himself a very different reputation from what he has now got. Nay even the good people of Edinburgh themselves would act more wisely were they to complete the building on the Calton Hill, before they think of such matters as the Monument to Sir Walter Scott, unless indeed they are of opinion that, notwithstanding his hundred volumes, he is likely to be forgotton by the next generation.—Not the least singular circumstance of all is that beyond its name being mentioned, there is no notice of the 'National Monument,' on the Calton Hill, in John Britton's 'Modern Athens,'—a very remarkable work by the by, if only on account of its exceedingly funny dedication to "My Dear Sir Walter."

V. 'What is your opinion,' said a friend to me, 'of Italian Architecture?'—When I know what you mean, was my reply, I can perhaps answer you, but you might just as well ask me what is my opinion of English literature, without particularizing any further, and I should tell you, perhaps that at the present day a great deal of it is most arrant slipslop, and another great deal confoundedly villainous—to wit the Newgate school of it. So too, in Italian architecture there is a vast deal of most horrible rubbish, and also much that is admirable and delightful. Between such men as Francesco di Giorgio, Sanmicheli, Balvassore, Peruzi, and Borromini, with a long et cæteri, the difference is incalculable,—as great as between Charles Barry and *Mister* Nash.—As for Palladio I freely abandon him to his admirers.

VI. Never need the country be put to expense for a monument to George IV., because, as long as it stands, Buckingham will prove a monument of his—dotage. And surely his taste—if he ever had any must have been quite in its dotage when he approved of Nash's designs for that unfortunate building. 'Tis a thousand pities that two old gentlemen should have laid their heads together to palm such a piece of architecture on the country. In one particular, indeed, it may be said to resemble Perrault's façade of the Louvre, inasmuch as it has coupled columns—*hoc Ciceronis habet*: but then even in that respect, it is egregiously more faulty, columns in pairs being introduced into a prostyle portico, whereas in the other edifice they form lengthened colonnades. On the other hand, although the mode of columniation adopted for the centre portico is rendered more glaringly offensive, by there being only single columns in those at the ends of the wings. After all, defects of this kind shrink to nothing when compared with the insignificance, and the pettiness of manner which characterise the whole building.

VII. The York Column is a prodigiously blank affair altogether,—one excuse for which may be that it would have been a puzzling, and somewhat ticklish affair to introduce any kind of sculpture, because the most appropriate and characteristic symbols would have been a gaming-table and dice-boxes, in allusion to the exploits, the heroism, and the martyrdom of the Royal Duke. Yet if as a piece of architecture that pillar is any thing but admirable, it may be turned to admirable account as a warning, and it is devoutly to be hoped that nothing similar will now be perpetrated in Trafalgar Square; especially as there is no occasion whatever to make the buildings around it appear at all lower, or more insignificant than they now do; which would infallibly be the case should a "huge bully" of a column be erected in the centre of them.—According to the newspapers, however, it would now seem that the Nelson Column is to be begun forthwith, on the strength of subscriptions coming in, which may *perhaps* provide a statue for the top of it; if not, *tant mieux*, for then it must at all events prove a *capital* affair.—Or commemorating Nelson so flagrantly would it not be just as well to commemorate him *fragrantly* after the manner in which Delcroix has just *commemorated* a recent event by his 'Bouquet de *Noces* Royales,'—which it should be observed does not exactly mean Royal Noses, although intended to tickle the noses of gentility. —I am afraid that Delcroix is a sad wag.

VIII. According to a recent German writer who professes to enlighten his countrymen as to our national character, English people, especially those of *ton*, are exceedingly shy of Munich, whose noble buildings and treasures of art possess far less attraction for them than do the coteries and gaming-tables of such places as Baden-Badin. There is, it is to be feared a great deal of truth in this; yet hardly is it to be wondered at, if the same satirical writer be correct in the classified catalogue he gives of the kind of English who visit the Continent, for he states that out of every thousand, 333 are half-pay officers, 100 ruined gamblers, 20 cast off kept mistresses, (who affect to pass for patterns of virtue,) 48 'Greeks' on the look out for 'Pigeons,' 50 economists—political ones of course,—who adopt the prudent economy of getting beyond the reach of their creditors, 10 people of wealth and rank, who, by way of change, *ennui* themselves abroad pretty much after the same fashion they do at home;—to cut this formidable list short,—just one Englishman in a thousand, who visits the continent in order to gain information and improve his taste. Assuredly the picture is not a very flattering one,—doubtless much exaggerated, but correct or not says a very great deal, because it shows in what light we are looked upon by foreigners. The same writer sets us down as absolute barbarians in music, which he says, we only hypocritically affect to admire without the slightest feeling whatever for it; and if he does not censure our taste in architecture, it is in all probability because he does not touch upon that subject at all; else, I conceive, many of our moderns would have excited his bile, not a little. However, be our taste in architecture what it may, we cannot be accused of much hypocrisy or affectation there; for the public generally do not care even to pretend to know any thing whatever about architecture. —Where our buildings have been spoken of by Germans, it has seldom been in terms of commendation; and it would not perhaps be amiss, if some of our architects were to read a few of their comments, and make themselves acquainted with their opinions, for though they could hardly fail of being an exceedingly unpalateable, they might also prove a very salutary dose to them.

IX. It is astonishing what downright silliness and nonsense is frequently made to pass for argument. A notable instance of the kind occurs in the article Architecture in the celebrated Encyclopédie Methodique, where it is said "La colonne doit être ronde, parceque la Nature ne fait rien de quarré." The same mode of reasoning might be employed to convince us that the surface of walls ought to be rugged, and floors uneven, *because* nature does not make the face of rocks perfectly smooth, nor the ground perfectly solid and level;—or again that besides being round, columns ought to have a rough surface, resembling the bark of trees,—for we suppose it is to the stems of trees we must look for the prototype of the shaft of columns. Besides, if columns are to be made round *because* nature makes nothing square, would not that be an excellent reason for making the architrave round or cylindrical also, merely cutting away so much of the under surface at intervals as would be requisite for its resting firmly on the flat abaci of the capitals. This might be done; and according to such theory, it would be both correct and natural,—perfectly in consonance with the BECAUSE assigned. Nay, might we not say that the convex or pulvinated frieze frequently given by Italian architects to the Ionic entablature is formed upon strictly rational principles, namely, agreeably to the aforesaid BECAUSE. But then if columns are round, because, &c.—how happens it that the abaci of their capitals are square? —or are we to suppose that while Nature herself shapes the columns, she leaves her apprentices and journeymen to make the capitals, &c. as well as they can. The sober truth is, all such reasoning is mere rigmarole, and if no more rational and likely *because* can be found out, as I apprehend could be, it is not worth while attempting to offer any at all.

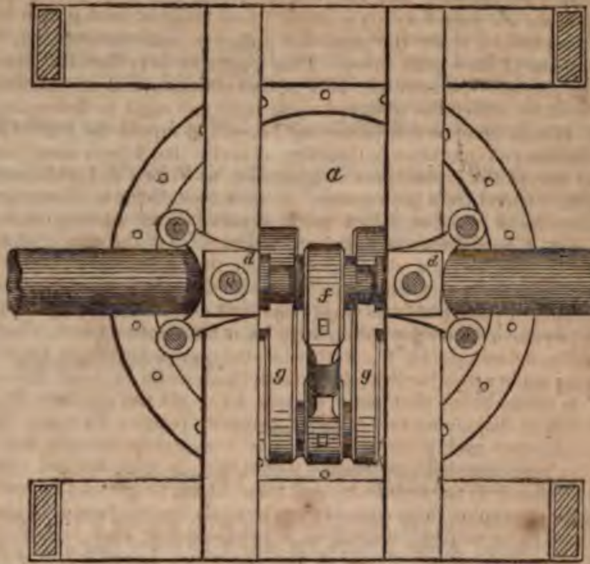
X. The real BECAUSE wherefore we make our columns round, is no other than because others have invariably done so before us; for which, again, there may have been more than one reason, and among the rest that of convenience, a circular shaft or pillar occupying less space than a square one of the same diameter, since the latter exceeds the former by the difference between the measure of its diagonals and its sides. Besides which, round pillars offer a greater contrast to walls and other flat surfaces, consequently tend to produce variety, while, at the same time, such form recommends itself as being, in some degree, more consonant to the prototype furnished by nature in the stems of vegetables and trees; and more studied and artificial also—more *recherché* than the other. Yet, although exemple and habit alone, independently of other considerations, cause us to regard the circular form as the most suitable, as well as the most beautiful, one for columns, it does not exactly follow that square ones are absurd—contrary to both beauty and reason, and that they ought never to be admitted at all. It is true no authority for insulated pillars of such shape, is to be met with in Grecian architecture; but then, neither does it supplyus with precedents for antæ or pilasters continued along the front of a building, and many other things which are nevertheless practised without scruple, even where Greek architecture is professed to be closely followed. I do not pretend to say that square columns are so well adapted as others for general purposes, but there certainly are cases in which they might be introduced both with propriety and effect, either by themselves or in combination with circular ones, and either way would produce greater variety of design than can be obtained by restricting ourselves on every occasion to the use of round columns. Hardly will it be expected that I can explain myself more fully without sketches and cuts; yet I can mention one instance where I conceive a good effect might thus be produced, which is supposing it necessary or desirable to have two insulated orders, one above the other, forming, for example, a lower and upper portico, that below might have square pillars—not mere piers—of about the same diameter as the columns over them; whereby, not only would a monotonous repetition be avoided, but greater solidity would be obtained in the basement order.

XI. Would it be believed that a professed architectural writer, no other, in fact, than M. Quatremere de Quincy, speaks of "Vasbrug ou Væsbrug," under which queer metamorphosis he gives his readers the name of the architect of Blenheim. If it arises out of sheer ignorance, of the inability even to copy a word correctly when in print, what reliance is to be placed upon his accuracy. On the other hand, if it is merely the affectation of ignorance, it amounts to downright puppyism. The most ignorant Englishman would not say Boiler, or Vaultair (instead of Boileau and Voltaire;) at least, no English biographer would so designate those writers. But the truth is, that, in literary blunders, one Frenchman is at any time a match for two Irishmen. Among ludicrous instances we may find, "Hirzel an Gleim über Sulzer," translated "Hirzel sur le Gleim," with a note explaining that "Gleim est une petite rivière de l'Allemagne." ! Poor Gleim! his poems must have been watery compositions indeed. Another Frenchman confounded Pressburg with St. Petersburg; and we now find Vanbrugh converted into Vasbrug or Væsbrug, which double mistake plainly proves it not to be an error of the press.

Rennie's Trapezium Paddle-wheel.—We understand Mr. Rennie has fitted the Lily, one of the boats plying between London Bridge and Hungerford Market, with his patent trapezium paddle, and that her speed is improved, as well as having done away with the swell caused by the ordinary paddle.

MAUDSLAY'S AND FIELD'S STEAM ENGINE.

Fig. 1.

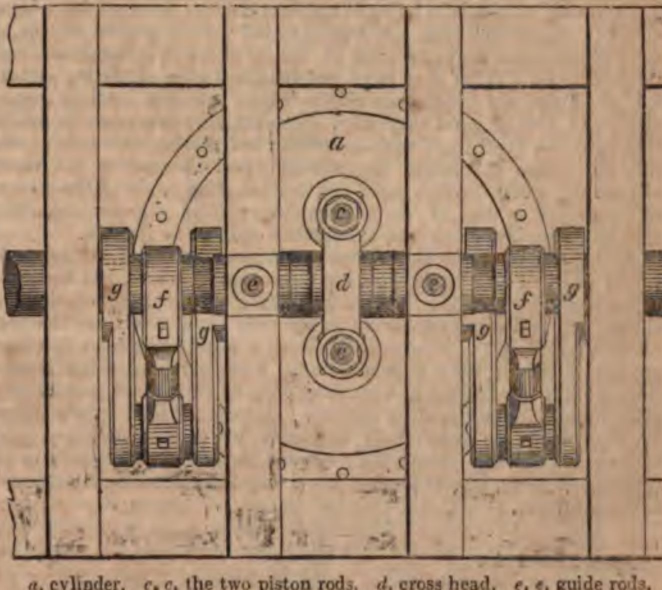


a, cylinder. *c, c, c, c*, the four piston rods. *d*, cross head. *e, e*, guide rods *f*, connecting rod. *g g*, crank.

SIR,—Your March number of the Journal contains drawings and a description of Messrs. Maudslay and Field's patented improvements in marine steam-engines, and it is on the second feature of their invention I have presumed to offer a few remarks and suggestions. Moreover, it is generally observed, that when a person obtains a patent right for any invention, it no sooner publicly appears to the mechanical world, than it is followed up by a modification of some sort, that modification being more or less effective, costly, or practical; and it sometimes happens that by means of such modification, schemes which, as they occurred originally to the mind of the inventor, could never have answered, have, in their effect, exceeded his (the original inventor's) most sanguine expectation. However, the inventors in this case are practical men (the most extensive, perhaps, in the kingdom), and it may be thought presumption in me to offer anything which might seem an improvement on their schemes, but my anxiety for the advancement of mechanical science must be my excuse.

It will be seen from the engraving, and it is obvious, that the crank shaft is placed on one side of the piston rods, consequently the action of the piston cannot be communicated to the crank pin in a direct line

Fig. 2.



a, cylinder. *c, c*, the two piston rods. *d*, cross head. *e, e*, guide rods. *f, f*, connecting rods. *g, g, g, g*, cranks.

How far this may answer in practice I don't know, but the theory does not look well.

It will be apparent that the proper place for the crank shaft is in the line of the centre of the centre of pressure, or centre of the cylinder, and to obtain such place, I propose that there be four piston rods uniting in one cross head, as shewn in Fig. 1. The sectional area of the four rods would require to be very little greater than for two or only one rod, but of course there would be the additional friction caused by the enlarged surface.

The arrangement is sufficiently shown in Fig. 1, without any further description.

Fig. 2 is another plan for keeping the shaft in the same central position with only two piston rods; in this case there will require a double cranked shaft as shown, and of course two connecting rods.

By the arrangement in Fig. 2, cylinders of a minimum diameter may be employed.

Messrs. M. & F. may have thought of these methods of combination, or they may not; however, Sir, if you think the above worthy a place in your Journal, nothing would give greater satisfaction to

AMICUS MACHINARUM.

April 8th, 1840.

THE ASSIZE COURTS, LIVERPOOL.

SIR—The decision has just taken place with respect to the designs for the Liverpool Assize Courts, for which no fewer than eighty-five designs had been sent in on the 1st January, and the two lucky competitors to whose lot the premiums have fallen, are Mr. Elmes of London, and Mr. Grieg of Exeter. During the present week there is to be an exhibition of all the drawings at the Town-hall, Liverpool, but the time allowed for its being open is so exceedingly short, that very few professional men here in town, or at distance from Liverpool, will be able to avail themselves of it, more especially as no public notice beforehand has been given of it in the newspapers,—which certainly ought to have been done. Besides which, the same egregious blunder has been here committed,—or if not blunder, the same crooked and perverse policy has been here pursued, which has justly been animadverted upon in similar cases; namely, instead of preceding the decison, the exhibition is not allowed to take place until it is over, and all appeal from it rendered unavailing.

This surely might be remedied—at least might be attempted to be remedied by the Institute, who ought to draw up and publish a protest against such a highly injurious mode of procedure, and ought also for the future, in every similar case of the kind, that is, in a public competition for a building of any magnitude, and in which numerous members of the profession are likely to engage,—to address themselves formally to the committee—or, however, the presiding powers may be styled, and urge upon them the propriety and decency of granting a public pre-exhibition of the designs, and that too, for a reasonable and satisfactory time.

I certainly cannot help being of opinion, that the Institute have been culpably supine and remiss in regard to the very important matter of competition; and negligent both of the interests of architecture and its professors. What they have yet done towards advancing either, I do not know, nor have I been able to learn: probably, let their disposition and zeal be what they may, there are very few cases in which that body can exert itself with any effect; but that becomes only an additional reason wherefore they should exert themselves the more strenuously wherever they can; and in attempting to check the abuses of the present system of competition and establish a better one,—the Institute would, at all events, have public opinion on its side.

As regards the particular competition here mentioned, it does look rather odd that Mr. Elmes, who, but a few months before, had been the successful architect for St. George's Hall, should have obtained a second and still more expensive in the very same town, ere the first one has been fairly commenced. Indeed, it is rather singular that that gentleman should have chosen to enter a second competition immediately after succeeding in a previous one, unless he had particularly good reasons for anticipating success. However, it is to be hoped that his design will be found fully to justify his so extraordinary good fortune, and thereby remove the awkward impression now likely to be made upon those, who at present know only the curious fact itself, and nothing further.

I remain, &c.

April 27th, 1840. Q.

GREAT WESTERN STEAM SHIP COMPANY.

THE annual meeting of the Great Western Steam Ship Company took place on the 28th March, when discussions took place highly interesting, both in a professional and public point of view. The question in dispute is as to the propriety of the steps taken by the Directors in constructing an iron vessel of unparalleled size, and in erecting a manufactory for supplying the public with engines.

The first question is with regard to the size of the vessel, which, as we should state, is to be of 312 feet in length, 42 feet breadth of beam, 32 feet depth of hold, 2500 tons, and with engines of 1000 horses power. The reasons assigned for this step by the Directors are, the increase in stowage afforded by the use of iron, increase of power, and consequently quicker and more certain passages. To these reasons the objections are objections of expediency, and a question of expediency this must be considered in all its bearings, mixed up as it is with the circumstances of the company, and the objects for which it has been projected and carried into effect. It seems that the capital of the company is small, and the difficulty of raising funds at the present time is very great, and consequently, on that account, it is inexpedient to engage in large enterprises, for which the funds are insufficient, and from which the returns cannot be obtained quickly, nor depended on with certainty. What is wanted at the present period is to have more frequent steam communication between England and the United States, so as to make the use of steam habitual, and its advantages permanently manifest, and not to be looked on merely as a casual relief to the regular sailers. It is *only* in this way that the liners can be successfully competed with, for it seems the saving of time is still so little appreciated, that, by a reduction of fare, they have been enabled successfully to contend with the large steamers, and force them also to reduce their prices. The Great Western, also, at present, has rarely her full complement of passengers, and in the last three trips, there has been a considerable falling off, so that the necessity of a large vessel on the score of accommodation, evidently cannot be asserted. The Company will also, in the course of this year, be subjected to the competition of numerous steamers, so that they will be the more called upon to preserve the regularity of their communications, while they must necessarily have *speedily* a new vessel on the station, not only for the purpose of securing quick returns to the proprietors on their capital, but to prevent them from losing all profit in the event of the temporary or total incapacitation of the Great Western. On all economical grounds, therefore, the construction of a vessel of a larger size than the Great Western is clearly inexpedient, and indeed the proprietors, in giving their consent to the construction of an iron vessel, never contemplated any increase of dimensions. Supposing, even, that the experiment should be successful, the Directors will not even then be exonerated from blame, in having unadvisedly made such an attempt, so uncalled for by the circumstances, and highly perilous to the financial prospects of the Company. We now come to the question of the propriety in an engineering point of view, of engaging in such an undertaking, and we find that not only has it no example, but, from the highest authorities, it meets with no encouragement. We do not say that an iron vessel 312 feet long cannot be constructed, but we must say that it augurs considerable temerity to attempt it in the teeth of the opinion of those most competent to judge. The largest iron steamer which has been built is only of 460 tons, one sixth of the size of the proposed vessel, and Mr. Laird, the engineer, positively refused to contract for an iron vessel of only 1850 tons, so little was he disposed to proceed without some practical result upon which to base his operations. Mr. Ditchbourn, the eminent iron shipbuilder, of London, expressed himself to a similar effect before the Committee on Steam Communication with India. It must be further recollected that the Company's vessel, instead of being under the responsible control of a private builder, is being built in their own yard, so that, should it prove a failure, the proprietors have no remedy. As if to heap experiment on experiment, the Directors have chosen to adopt a form of engine, of which the best that can be said is that it has not succeeded, if, indeed, it be not regarded as a total failure. Humphrys' Patent Engines will be found in another part of the Journal to have been patented as Mr. Broderip's, in 1828, by Col. D'Arcy, and how they ever came to be called after Mr, Humphrys, no one presumes to surmise. A pair of them was put on board the Dartford, built at Gravesend about four years ago, for Messrs. Halls, of Dartford, by Mr. Baulckham. The lines of the Dartford were very fine, and she had a very promising appearance; when, however, her engines came to be put on board, so far was she from justifying the predictions of her proprietors, that they were obliged to give up running her on the Thames, after she had been beaten by most of the boats on the river. She was then being also found to be dissatisfactory, she has been repeatedly offered for sale, without success, at less than half price, and may now be found in the East India Docks with a broom at her masthead. Both Maudslay and Seawards refused to construct engines on this principle, and Mr. A. Mornay has written a paper to show that the trunk engines are good for nothing at all. Mr. Brunel, in defending the character of the Dartford, very gravely assured the Bristolians that she had beaten the "City of Glasgow" by two hours in going to Portsmouth, a fact, which, if true, it is very fortunate for him that he did not state in London, for here the City of Glasgow is a byeword for slowness, a kind of *Regulator*, by which all the other steamers go. Having said thus much, we shall now proceed to show, by a few calculations, the justness of our remarks.

The engines are to have cylinders of 10 feet diameter and 10 feet stroke, and thus, according to the usual computation of 7 lbs. effective pressure on the square inch of the pistons, assuming their speed to be 240 feet per minute, would be equivalent to 1151·5 horses power, if of the ordinary construction; but as they are to be made with the trunk, half the transverse section of the latter must be deducted from the area of the piston, (say one-fifteenth of the area of the piston), by which the nominal power of the engines is reduced to 1075 horses power. They are expected to weigh, without the boilers, one third less than common engines; we may then fairly assume that they will weigh, withthe water in the boilers, 800 tons.

It is difficult to imagine the motive which has induced the Directors to cram this *enormous* power into their intended vessel, the proportion of power to tonnage being about what is allowed to small boats; for by so doing they forego the chief advantage which large steamers possess over small ones for long voyages. The natural consequence is that the vessel will be able to carry little or nothing besides the requisite fuel for the voyage across the Atlantic.

The whole area of one of the pistons is 78·54 square feet, from which if we deduct one fifteenth for the half area of the trunk, we shall have for the mean area acted upon by the steam, 73·3 square feet. The mean capacity of one of the cylinders is, therefore, 733 cubic feet. If we suppose the diameter of the paddle wheels to be 36 feet, the vessel cannot be expected to advance more than 83 feet 9 inches for each revolution, which with 12 revolutions per minute, would give a speed of nearly 10 knots an hour, and the voyage from Bristol to New York would require the wheels to make about 220,000 revolutions, For this 880,000 cylinders full of steam will be used, but as under favourable circumstances the steam is to be used expansively, we will suppose it, on an average, to be cut off at half stroke during one half of the voyage, and used at full pressure during the other half. On this hypothesis only 660,000 cylinders, full of full pressure steam, will be expended, exclusive of waste. This is equivalent to 483,780,000 cubic feet of steam, to which if we add 10 per cent for waste, the total expenditure of steam will be 532,158,000 cubic feet. We understand the steam is not to be used at a higher pressure than 4 or 4½ lb. above the atmosphere; at the former pressure one cubic foot of water is required to generate 1356 cubic feet of steam, so that to produce the above quantity of steam 392,447 cubic feet of water must be evaporated.

Mr. Armstrong in his work on the Boilers of Steam Engines, gives 10 lbs. of coal as the quantity requisite to vaporize one cubic foot of water, but as the usual allowance for marine engines is only 9 lbs., we shall adopt this as the basis of our calculations. On this hypothesis the consumption of coal during the voyage will amount to 1580 tons nearly (say 1600 tons, to allow for emergencies). At the commencement of the voyage the resistance of the water to the vessel's motion will be of course greater than when she is light; and by the consumption of some of her fuel, the engines will not be able to make their full number of revolutions; and it cannot be doubted that under these circumstances a greater amount of fuel will be consumed in the same distance than when going at full speed, so that it will be scarcely safe to take less than 1600 tons on board at Bristol, particularly as the passage out may be reasonably expected to be prolonged by adverse winds, which do not occasion a reduction in the consumption of fuel *proportional* to the diminution of the vessel's speed; for it is clear that, to obtain an equal resistance with fewer revolutions of the paddle wheels, the floats must slip more through the water, and consequently the progress of the vessel must be less for each revolution of the wheels than when she has no contrary wind to contend against. Now the quantity of fuel consumed is proportional to the number of strokes of the engines, therefore the consumption in a given distance, although not proportional to the time occupied, will be greater when the speed is reduced by adverse winds than otherwise.

The directors have announced that the vessels displacement will not exceed her tonnage, or but slightly, and that she will not vary in immersion between Bristol and New York more than 2 feet 6 inches. attempted to be run to several places on the south coast, but this

Now the weight of the hull, masts, yards, sails and rigging, boats, cabins, fittings, &c. cannot be safely estimated at less than	1100 tons
The engines and boilers with water	800
Fuel	1600
Making altogether (without any cargo)	3500 tons.

which is already 1000 tons more than the measured tonnage of the vessel. Her draught of water will, therefore, be 3 feet 6 inches, or perhaps 4 feet more than it is expected to be.

On a rough computation we estimate that the vessel's draught of water will vary about 5 ft. 6 in. during the voyage, by reason of the consumption of 1500 tons of coal; and for this reason, as well as on account of the immense power of her engines, the paddle wheels cannot be made less than 36 feet in diameter, with 32 floats on each, measuring 15 feet in length and 4 feet broad. With a less diameter a speed of 10 knots an hour could not be hoped for with 12 revolutions per minute, even in calm weather, and with smaller or fewer floats the engines would probably over-run their speed, when the vessel was lightened by the consumption of the chief part of the coal. If, therefore, with the floats immersed 4 feet, the wheels make 12 revolutions per minute, and the vessel attains a speed of 10 knots, as assumed above, the engines will be brought up to about 7 or 7½ revolutions at the beginning of the voyage with 1600 tons of coal on board, which would immerse the floats 9 feet 6 inches instead of 4 feet, and the speed of the vessel would most probably not exceed 5¾ to 6¼ knots.

As regards the expense of the new vessel, as estimated by the Directors, we will call attention to the fact that the price per cwt. of angle iron, plates, &c. increases with their weight, and, if the "Rainbow" cost 60*l*. per ton weight of iron (which is the fact), it is not unreasonable to assume that the new vessel will cost 80*l*. per ton; but taking it at 70*l*. only, and the weight at only 650 tons, the hull

alone will cost	£45,500
Adding to this for masts, yards, cabins, stores, &c.	15,000
And for the engines at 35*l*. per horse power	35,000
We find for the cost of the vessel	£95,000

which exceeds her estimated expense by 20,500*l*., irrespective of all preparations, accessories, buildings, tools, &c.

The tools are to cost 30,000*l*., out of which we find by the last report that 19,000*l*. was paid, and out of the cost of the vessel 6,800*l*.,

leaving still to be paid for the vessel	£ 88,700
for the work shops	11,000
By the same report there was expended	105,500
Required to pay debts due	11,000
Making in all	£216,200

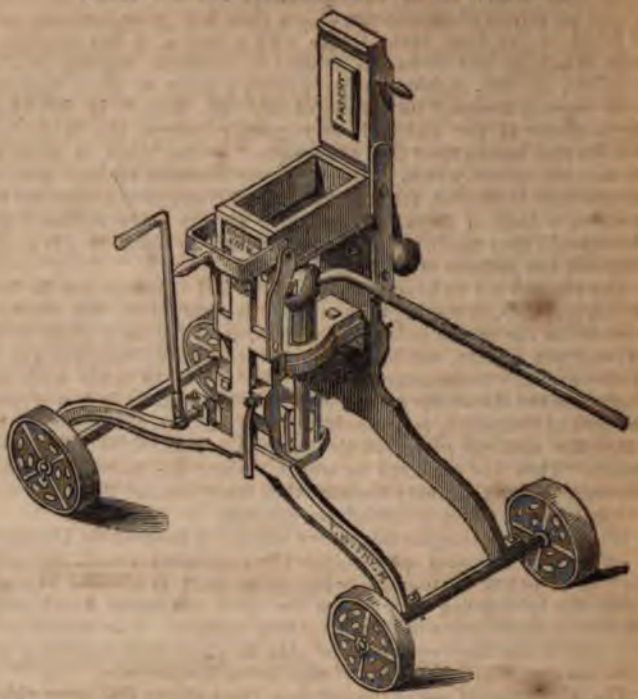
The total number of shares taken falls short of 1,900, and assuming them at that number, and that all calls will be paid, the gross capital of the Company amounts to 190,000*l*., or 26,200*l*. less than the inevitable disbursements before the completion of the new vessel. Besides this there will be the rent of premises, clerks' salaries, expenses of management, &c. during the term of completion, which cannot be safely estimated at less than two years.

Having shown the temerity with which the directors have acted, both in regard to the size of their vessel, and the engines by which it is to be worked, and having proved that it is inexpedient and injurious, we have next to consider one of the most outrageous propositions that was ever suggested to a public company, that of setting up a factory for making vessels and engines. Without any attempt to ascertain on what terms the vessel and engines might have been constructed by contract, the directors have themselves determined to execute both, and have accordingly already laid out £20,000, being *one fifth* of their capital, in the purchase of leasehold property! in digging docks! and in buying machinery! and as if it were not enough to waste the limited capital of the unfortunate shareholders in such speculations for their own uses, but, as if to add the climax to their proceedings, they actually propose to organize a regular factory for making vessels and engines for whomsoever will buy them. With a capital totally insufficient for the legitimate objects of the Company, and having unadvisedly engaged in a most hazardous and unwarranted speculation, the directors waste the resources of the shareholders on objects which it will require a long time to make available. As to how they propose to find money for finishing this vessel, which will certainly cost much more than their estimates, or for carrying on their extraordinary operations, no one can conceive, unless they are to bring half shares into the market to divide equally with the original proprietors. To aggravate the injury in particular cases, they are literally employing the money of Mr. Acraman, the great engineer, in competing with himself. With regard to the legality of their proceedings, it requires very little knowledge of law to be aware that it is only under a new deed of settlement that the directors can carry out any such plans. As to the propriety of engaging as rivals to private manufacturers, public opinion is too strongly against such a practice to render any further comment necessary, while, as concerns the shareholders, if this departure be allowed from their original plans, there is no reason why the Directors should not set up chain-cable works, rope walks, sail lofts, machine biscuit bakeries, or anything connected or not connected with shipping,—they may engage in banking, life assurance, or any pursuit.

We cannot, therefore, but be of opinion that, on every point, the Directors are not only totally unwarranted in the course they have pursued, but are open to severe reprobation for their imprudent management of the affairs of the shareholders, whose property must, by such proceedings, be rendered more unsaleable than it is even at present. The future operations of the Company are in every way embarrassed, both by the mismanagement of the capital, and the heavy charge that must be created by such a lumbersome vessel and expensive establishment, which must be kept up, whatever may be the revenues of the Company. The report which recommends and justifies the course adopted, is of a most fulsome and trumpery character, with the stamp of official paternity strongly marked; the self-laudation is too apparent to be disguised, and, like on passing the line, every one of the novices is abundantly bedaubed with the glittering slime of the concoctors. The phraseology is as rich as the matter of which it is the vehicle, and renders the whole affair still more sickening. We do not think it necessary to give the report any lengthened examination, or we should waste the time of our readers and our own in exposing this tissue of egotism and presumption. Among other information which we see with regret is, that the Company have been compelled to accede to the grievous demands of the Dock Company, and pay a large sum for docks their vessels can never enter. They were obliged to take off the paddle-boxes of the Great Western to get it into Cumberland Basin, and, as if to make the difficulty greater the new iron vessel will be seven feet wider. This is making a man too large for his house with a vengeance, and we very little question that the Great Western Directors will, in time, in their zeal for the interests of Bristol, make their vessels so large that they will not be able to get up to the city at all. The experience and observation of the Directors and officials is very much praised, but if we are to judge by one example, we fear a little too much. They coolly state that a modification of the Great Western's paddle-wheels has been made, founded upon the results of accurate observations during her voyages, which modification, if we are informed rightly, so far from being an improvement, has had the effectual result of reducing the speed of the vessel. The *sang-froid* with which they mention the superiority of themselves and their yard is admirable; it shows a becoming obliviousness of the Maudslays, Millers, Boltons, Acramans, Seawards, Fawcetts, Napiers, &c.; their confidence in the estimates and opinions of the most eminent manufacturers is rich, the persons answering to this description are, the patrons of the Trunk Engines, Messrs. Halls, of Dartford, and a most eminent and practical man, in whom they put their trust, is Mr. John Scott Russell. Well may the directors talk about its being for *the interest of the shareholders that their singular appliances should be directed to manufacture and repair for other parties*, if they believe that any one can feel any confidence in their ignorance and quackery. We leave this subject with an earnest entreaty of the shareholders concerned to look about them, and get their affairs out of the hands by which they are at present mismanaged, or the end of the experiments will be the total ruin of their property.

Steam-Plough.—A trial was lately made in one of the fields on the estate of Fossil, near Glasgow, of the steam-plough, intended for the cultivation of the sugar lands of British Guiana. This trial was completely successful, and gave great satisfaction to the numerous party who witnessed it. The field was laid out similar to those in the colony, which have canals on each side running parallel with one another. The machinery consists of two iron boats, one containing a small high-pressure steam-engine, with a drum, round which the endless chain or rope is coiled, and the other a reversing pulley, by means of which the chain or rope is extended, and allowed to work whichever way is required; the ploughs are attached to this chain, and made to work backwards and forwards with great rapidity and accuracy. Mr. MacRae, whose long residence in the colony, and great practical experience of the working of sugar estates, had directed his attention, for a considerable time past, to the great and absolute necessity of employing some other power to supersede cultivation by manual labour, invented the steam-plough, which was executed by those enterprising engineers Messrs. Thomas Edington and Sons, Phœnix Iron-works, whose great ingenuity in constructing and designing the various parts was very much admired.—*Glasgow Courier*.

BAKEWELL'S PATENT BRICK MACHINE.



This machine is strong, of simple construction, and made of cast iron. The mould for receiving the brick is fixed at the top, the inside being accurately ground, and the bottom made to slide freely up and down, when operated upon by the screw and lever underneath; the top is made with a counterbalancing weight by which it is easily opened on withdrawing the catch that secured it. A winch is likewise connected with the underside of the mould to raise the brick after it has been pressed.

The process for pressing the bricks is as follows:—The bricks when half dried are placed in the mould, the lid closed and secured, the bottom is then forced up with a pressure of from 4 or 5 tons, by means of the screw acted upon by the horizontal lever. The brick is then raised out of the mould by simply forcing back the winch and removed by a boy; the bottom is then lowered by its own gravity, and is ready for another operation; by the aid of this press, between two and three thousand bricks may be pressed in a day with the labour of one man and two boys.

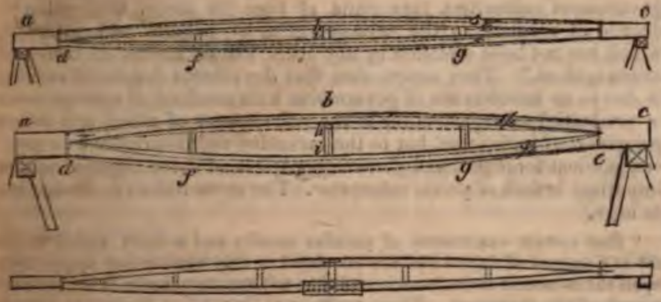
It will be seen that this machine does not profess to make the bricks, but is intended to improve them when made; this it accomplishes in a superior degree; the bricks when turned out of the mould have the sides smooth, and the arrises perfect and parallel, and when burnt, they retain their form, and are of great hardness; they are consequently, well adapted for facings of buildings and paving, as the joints can be laid quite close and regular, the bricks being all of an exact size: they are equally desirable, on account of their extreme hardness and near impermeability to water, for engineering works; particularly for arches and abutments, viaducts and bridges, foundations, retaining and dock walls, and other works requiring great resistance. The press may also be used for quarries or fancy bricks, which can be pressed to almost any form by merely changing the mould. This press has been in use for many years, more particularly in the midland counties where several public buildings have been faced with these bricks, which gives them a very superior character, far surpassing the bricks commonly applied to that purpose; and although the machine has been used very extensive by Mr. Rhodes, it is not much known in London. The front of Bielefield's extensive Papier Maché Works, in Wellington-street, are faced with bricks of this description. We understand that several parties are now in treaty for licenses, and that the introduction will shortly become very general. The extra cost of the bricks will be from five to seven shillings per thousand;—a sum comparatively small, for the superior quality of the brick, which cannot add very greatly to the cost of the building when used for facings only. The miserable looking brick buildings at the several railway stations, would have been much benefited by them, as they now exhibit generally a very mean and stable like appearance, which a clean well coloured facing brick, at but small cost, would have been easily prevented. We with pleasure recommend the attention of the profession to this important patent, which can be viewed at the proprietor's office, Adelphi Chambers.

ON TRUSSED BEAMS.

Invented by HERR LAVES *of Hanover, read before the Royal Institute of British Architects, on Monday, March* 20, 1840, *by* T. L. DONALDSON, ESQ., Fellow.

MR. LAVES took a beam of fir 40 ft. long and 9¼ in. deep, and 7½ in. wide, and supported at the ends. He gradually loaded it with 100 lbs. at a time, and found that when it had 1700 lbs. it deflected 5¼ in. He took a beam of the same dimensions and cut a horizontal slit to within 3·6 from each end, making the upper portion 5 inches deeper and the latter 4¼; he put iron straps at the ends, bound tightly round to prevent the slit from extending—he then forced the upper and lower part of the beam asunder by driving in blocks or wedges, until they were as wide apart as half the depth of the beam—he supported the beam at the ends and found that when he had gradually loaded it with 100 lbs. weight as before, until it bore 1700 lbs. it only deflected 3½ in., being 1¾ less than the solid beam. He then separated the slit apart 9¼ inchei or equal to the whole depth of the beam, and gradually loaded it until it bore 1700 lbs., when it deflected 2¼ or 3 inches less than the solid beam, and 1¼ less than the former. He then widened the opening of the slit 13⅛, or equal to a depth of 1½ of the solid beam, and loaded it in like manner with 1700 lbs., it deflected only 1¼ inches, being 4 inches less deflection than the solid beam. (See Fig. 1.)

Figs. 1, 2, and 3.



He then took pieces of fir 50 in. long, 2 in. deep, and 1 in. wide, one was left solid, two others were slit so as to make the upper part 1¼ inches deep, and the under ¾ in., one piece having the slit half the depth of the beam apart, the other ¾ of the depth apart. See fig. 2.

It will be perceived that the principle of this system consists in the combination of the two chief forces of materials, that is resistance to compression, and resistance to tension.

Resistance to compression is the one employed from the remotest periods in the construction of arches and vaulting, and requires great masses of materials; and resistance to tension has more lately been employed, at least in Europe, for the construction of suspension bridges by the application of chains, and requires less materials than the other principle of compression, but frequently the insertion and use of chains is obtained with difficulty, and produces vibrations and sensibly felt undulations.

These inconveniences have led to the application of this system. It will be perceived that the under line or chain attached at the two extremities of the upper curved line acts with positive force that of tension, which is the greatest possible force of materials varying from 10 to 20,000 lbs. on the square inch of the transverse section in various woods used in construction, and from 20 to 100,000 lbs. in metals.

The upper line or beam acts by relative force that of compression, and serves to prevent the lower line or chain from contracting the two extremities.

The lower line or chain hinders the upper line or beam from pressing out at the extremities.

The supports and braces serve to unite the upper and lower lines or beam and chain together, and then two forces neutralized form a complete whole, which sustains itself, and can neither thrust out nor draw in.

It is to be observed—1st. That the force of the chain is dependent upon the depth of the versed sine, and that the lower it is beneath the horizontal line or chord of the arc the stronger it will be. Arches of solid construction require a rise of 20 or 15 ft. for the springing of the arch to the soffit of the key stone, in a span of 100 ft; but the chains in this system, if they have a rise or versed sine equal to 4 ft. 2 in. in a span of 100 feet, the force of the chain reduces itself to one-third of the absolute product—if the rise or versed sine equal 6 ft. 3 in. in the same span of 100 ft., the absolute force could be reduced a half.

Observe 2dly. That the upper line or beam, on account of the elasticity of the materials, ought absolutely to have the convex form as in the diagrams, in order that when considerably loaded, the lengthening of the under line or chain by tension, and the shortening of the upper line or beam by compression, may not reduce the upper curved line to an horizontal one, beneath which it would no longer serve by resistance to the statical equilibrium of the construction.

We observe, 3rdly, That the method of tying together the extremities of the curved lines will depend on the materials employed, and must be calculated according to the weights that they will have to bear.

Such are the general principles of this system when applied in a horizontal direction.

We will now consider its application in a vertical or upright direction, and when used obliquely.

It is obvious that the resistance of a story post or stay, whether in wood or metal, increases in a fixed proportion according to its thickness.

For wood—the pieces of wood are sawn as before described with one cut, or two cross cuts to within a certain length of the ends, and these tied together by bolts or straps of iron. The cuts are then forced apart by wedged blocks and kept in their places by bolts or straps of iron.

For iron—by connecting together at the ends, two or more bars of iron, and separating the bars by wedges or pieces of iron, or iron rings.

The proportions and number of the different parts as chains, stays, posts, &c., depend upon the purposes to which they may be applied, and must of course be calculated accordingly by the architect.

The most simple practical application of this system is for the purpose of wooden bridges, and the upper line or beam may be materially strengthened, and the combination stiffened by the introduction of stays and braces.

If the span of the bridge exceed the length of one beam, two may be taken, sawn at one end only, and connected by two scarfing pieces, into which they must be fitted with notches, and bolted or strapped together so as to prevent their separating.—See fig. 3.

In those parts where the ends of timbers abut upon any joints or other timbers, it will be expedient to interpose thin plates of copper or iron, in order to prevent the but ends from driving by the force of compression into the beams, which would cause a sinking.

For occasional purposes or military operations it may be useful to adopt the same system applied to rough trees, which would even be picturesque and useful in parks and gardens—and by connecting the forked branches of two trees, to produce a combination which would answer every purpose.

For all the bridges hitherto described, it will be sufficient that the versed sine of the lower arc or chain equal $\frac{4}{100}$ or $\frac{1}{25}$ of the span. This is very moderate, for a beam requires $\frac{5}{100}$ or $\frac{1}{20}$ of the span, and bridges or arches of masonry or solid construction, a rise of $\frac{15}{100}$ of the span.

If the banks of a stream be too wide apart to admit the adoption of this system in one span, it will be necessary to have intermediate piers or columns, and to form a succession of framings tied together with iron straps, or constructed in cast iron.

If the bank of a river be too little elevated above high water mark, or if it were requisite to give greater height in the middle of a series of arches, in order to admit the passage of vessels, the lateral framings admit of a gradual fall to the banks without affecting the stability of the framing.

Various bridges upon Mr. Laves principle have been constructed.

1. One in oak at Hanover for foot passengers—the span 100 feet, width 12 feet—cost about 112*l*.

2. One in oak over the Nette river at Dernebourg, near Hildesheim—span 60 feet, breadth 15 feet, it being for carriages—cost about 70*l*.

3. One in oak for foot passengers, and a water pipe at Dernebourg, near Hildesheim—span 30 feet, breadth 10 feet—cost 26*l*.

4. One in fir for foot passengers over the Eger at Elnbogen, in Bohemia—length 36 feet, width 5 feet—cost 50s.

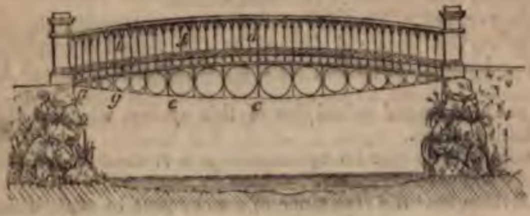
5. One in fir for carriages over the Eger at Altsaltel, in Bohemia, in two lengths, supported in the middle or junction of the two—total length 126 feet, width 15 feet—cost about 100*l*.

6. One for carriages in wrought and cast iron, in the Royal Park of Herrenhausen, near Hanover—length 83 feet width 20 feet—cost about 550*l*., comprising the wood paving for the carriage way.

Besides others at Salzau, near Kiel, in the Royal Park at Hanover, and one for the Count Munster at Dernebourg, near Hildesheim, varying from 22 to 42 feet span, and constructed in iron at a very moderate cost, all of which are described in Mr. Laves' pamphlet.

Figure 4 explains the construction of an iron bridge over a river, the upper line consists of hollow cast iron cylinders united by bands of wrought iron. The chain is of wrought iron, and the rings may be made either of wrought or cast iron. The hollow cylinders are for the purpose of producing lightness in the upper line, which is essential.

Fig. 4.



The application of this system to roofs and floors is extremely economical and useful, and by simple modifications serves for the covering of large spaces without any intermediate point of support, and presents this further advantage, that from its vertical pressure it requires no other support than walls of moderate thickness.

When applied to floors, bridging joists will remedy the inequality of surface in the beam itself.

In roofs of large span the posts may be continued up so as to receive the purlins, and when continued downwards serve to hold up the ceiling, whether flat, or vaulted, or mixed.

The principal rafters of a roof may derive considerable strength from being treated in the same way as in fig. 2, which combination is calculated for roofs of 50 feet span; by this arrangement of the principal rafters at distances of 10 feet apart, no intermediate stays or posts are necessary to support the purlins, so that a fine clear span space is left in the roof. Here the tie beam is slit according to Mr. Laves' system, and acquires sufficient strength to support itself without being tied up to a truss.

Mr. Laves has applied this principle to various roofs.

One in iron over the kitchen in the Royal Park at Hanover; one in carpentry of 50 feet span, over a barn belonging to the Baron of Wangenheim, at Wangenheim, near Gotha; and likewise one at Hersum, near Hildesheim, and over the scenery magazine of the theatre at Hanover.

The painting room of the scenery in the theatre at Hanover has the slope of the roof formed by rafters, slit down the middle and kept apart —the span 38 feet in the clear, and length 74 feet.

Another application of this system is to large ladders, which when very long, whether used for fires, to scale batteries of beseiged towns, or to board ships, had the inconvenience of being cumbersome, difficult of conveyance from one part to another, so that they could be managed only by numerous assistants; hence they were comparatively little serviceable for the end proposed, and frequently not able to be brought in time sufficient to render the assistance required.

In the case of ladders each of the sides of the ladder is sawn in two to within a certain distance from the ends, which are bound together by iron bolts or straps. The intermediate stays, used to keep open the cut, also serve to combine the forces of the two parts, and being continued are useful to receive a side cord, as an additional security to a person ascending or descending. A ladder so constructed may be placed in a horizontal position, and is sufficiently stiff to act as a temporary bridge or scaffolding, from the window of one house to that of another on the opposite side of the street, or from one vessel to another.

If the chain be formed of iron wire, it would answer the purpose equally well, and be tighter.

If it be desirable to place the ladder in a slightly inclined direction, without any immediate object to rest against, two props or supports should be placed against the uppermost rail or round, which, to avoid osciliation or bending, should also be composed of slight pieces of timber, sawn down the centre, kept apart by small intermediate blocks, and bound at the ends as already described.

MR. MOORE'S PATENT PLAN FOR FEEDING FURNACES, &C. FIRES, FOR THE CONSUMPTION OF SMOKE.—Mr. Moore proposes to have the grate-bars hollow semi-cylinders, with the concavities upwards. The fuel is put into a similar semi-cylinder scoop capable of sliding within either of the grate-bars, and being thrust in from end to end, is turned half round, and then withdrawn, leaving the fuel in the same cylinder bars, which is ignited from the burning coals above. The patentee says he has never found any difficulty in the scoop's forcing out the burnt fuel already in the grate-bars, and that the fire, by this contrivance, never wants any more stirring than is given by the introduction of the new fuel. Of course, the smoke is ignited and consumed **by passing up through the red-hot coals above.**—*Railway Magazine.*

STEAM NAVIGATION.

THE bold front shown by the Engineers and Steam Ship Builders, has shaken Mr. Labouchere's confidence in the propriety of the measure of which he is the official custodian, and, like a prim old maiden distrustful of the legitimacy of the little darling which she had been parading with so much delight, is prepared to modify his trust. He expresses his hope that the measure, as modified, will contain nothing distasteful to the engineers, and appears extremely anxious not to go at once into a discussion on the grievance. We hope that the engineers will think as we do, that this is not a question to be compromised, nor is it prudent to allow such a threatening attack to pass without notice, for the animus is too evident not to render the introduction of the bill certain, whenever its concocters can watch a fitting opportunity; we therefore warn all concerned to be prepared at a moment's notice to oppose this obnoxious measure.

We have felt ourselves strengthened in the course we have adopted, in the consideration of this momentous question, by an able memorial which was addressed to Congress in February last, by the proprietors and managers of steam-boats in the United States, who, so far from concurring in the wisdom, even of the modified code brought forward as an example by our commissioners, boldly declare its injustice and inefficiency. Fearless of all the exaggerated horrors of newspaper paragraphs, and of the facts and pseudo-facts raked up by government authorities, they claim at once for steam navigation "a degree of security in the transportation of persons and property, which has not been equalled by any other known means of transport or navigation." They assert, also, that the present degree of security is due to no interference of government with mechanical arrangements or prudential management, or to the enforcement of novel and severe principles of legislation, but to the inventive and discriminative powers, prudent foresight, and persevering spirit, of those engaged in that important branch of public enterprise. The memorialists go on further to urge,

> "That certain enactments of peculiar novelty and severity, found in the act of Congress of July, 1838, are calculated to bear harshly and oppressively upon the owners of steam vessels, and thus to affect injuriously, this important branch of our navigation. These enactments, instead of furnishing encouragement for a just and generous rivalry, in bringing steam vessels and their machinery to the highest possible state of security and perfection, have, unfortunately, in the view of your memorialists, a direct tendency to deter men of prudence, capacity and property, from further connexion with this business; who are unwilling to submit to implied reproach and degradation, to unwarranted hazards, and to the loss of rights and privileges which are guarantied to all other persons engaged in a lawful calling. Your memorialists refer more especially, to the clause which deprives them of the universal legal protection common to every civilized country, by unjustly construing, in the event of any serious disaster to life and property, the presumption of innocence into *prima facie* evidence of guilt: and they respectfully request of your honourable body, that a provision which is so much at variance with their fundamental rights and privileges as American citizens, may be repealed.
>
> "It is with painful regret that your memorialists have noticed an attempt to procure a broader and more mischievous application of this unjust principle, by means of proposed additions to this law; and they respectfully ask of Congress to be protected from such proposed aggravations of the already severe and relentless doctrines of the common law as it now governs the responsibilities of common carriers; and which, if enacted, must tend to destroy every just inducement for longer continuance in a business which is subjected to such unprecedented liabilities to loss and ruin. These extraordinary hasards and liabilities, it should be noticed, will not pertain to our competitors under a foreign flag; and our citizens may thus be virtually excluded from navigating the ocean by steam. Your memorialists would further remark, that if with the best knowledge possessed by this or any other country, this species of navigation be deemed too hazardous for the public safety, they deem it more just and honourable to submit to its entire prohibition.
>
> "Your memorialists believe that few opinions are more erroneous than that which ascribes to the provisions of the existing law a generally increased safety for persons and property carried in steam boats. This may appear from the many accidents or disasters of a serious character which have taken place during the short period in which this law has been in force. The number of these accidents on the western waters during the last year is stated to have been forty; which may serve to convince Congress that the appropriate remedies for these disasters are not furnished by this law; and can be found only in the increasing practical knowledge and skill of those persons who are engaged in the construction and management of steam vessels.
>
> "Your memorialists do not seek to escape from any just responsibilities in conducting this important business. On the contrary, they feel bound to furnish every reasonable guaranty for safety to life and property which human foresight and prudence may be able to afford: and it is for the purpose of furnishing these guaranties in the most direct and practical manner, that they further respectfully but earnestly request, that Congress will call to the aid

of its committees, to whose protection this important branch of navigation has been intrusted, the information and experience of some of the individuals whose lives have been devoted to its improvement and practice from its earliest origin in this country :—in order that practical knowledge may form the basis of legislation upon a subject which affects more or less directly the interests and business of, probably, a great majority of the American people."

The memorialists here declare, unequivocally, that such restrictions, instead of producing improvement, must retard the progress of science, and check the employment of capital, without, at the same time, ensuring the objects, which they are intended to effect. To show how little desirous they are of concealing facts, and how little daunted by the exaggerations of their opponents, the memorialists append to their pamphlet Messrs. Pringle's and Parke's concoction of one hundred accidents, which have occurred to English steam-vessels, leaving the ungullible portion of the public to form their own comments on the case. These commissioners remind us of the quack who attempted to frighten the old lady out of her tea, by assuring her that it contained a millionth part of prussic acid, and that it would certainly carry her off. "A very slow poison," said she, "for it has been eighty years about it already." Facts show that the loss of life by English steamers, in the very worst year, 1838, was not one twentieth of the number annually lost in sailing vessels, and the amount of property not one fiftieth. On the coasts of the United States last year, above 400 sailing vessels were lost, and 1000 lives. On the New York waters the contrast is as strong.

"Those who have laboured to inflame the public against these unfortunate men may well be reminded, that it is now thirty years since the public have enjoyed the use of passenger vessels impelled by fire and steam, and that during this period not less than *thirty millions of persons* have been transported from time to time, in the various steam boats which have run to and from the city of New York, and that these steam boats have probably navigated a distance equal to *fifteen millions of miles*, and that in all this prolonged and varied exposure, *never, but once, has a single life been lost by the burning of a steam boat*. This fact alone, to the unprejudiced, speaks volumes in favour of the general care and skill of the parties, who have been concerned in this species of navigation."

To expose the absurdity of the protection law, and to give a fair idea of what it may be expected to produce here, we give the following table of known accidents and disasters to American steam-boats since the law of 1838, which was to have been such a palladium to the old women.

1838 Oct. 27th	Cynthia,	Detroit River,	Burnt; passengers and crew saved by running on shore.
Nov. 25	Gen. Brown,	Mississippi,	Explosion, thirty lives lost.
1839 January	Clarendon,	Sav. & Darien,	Burnt; crew and passengers saved.
"	Ploughboy,	Mobile,	Sunk, on arriving at Mobile.
"	Somerville,	Mississippi,	Sunk.
February	Oswego,	Ohio,	Sunk, near the mouth of the Kentucky.
"	Alert,	Mississippi,	Eruption of steam; 4 scalded.
"	Alice,	Pearl river,	Sunk.
March	Reporter,	Ohio,	Eruption of steam; 4 scalded.
"	New York,	New Haven,	Burnt.
May	Avalanche,	Ohio,	Eruption or collapse; 5 killed.
"	Rhine,	Missouri,	Explosion.
"	Pilot,	Mississippi,	Explosion or collapse.
"	Ponchartrain,	New Orleans for Tampico,	Explosion.
"	Geo. Collier,	Mississippi,	Eruption of steam; forty-five killed or scalded.
"	Eric,	Hudson river,	Collapse, 1 slightly wounded.
"	Bee,	Arkansas,	Sunk.
"	Indian,	"	Sunk.
"	Buckeye,	Mississippi,	Explosion; several killed or wounded.
June	Empire,	Oh o,	Sunk.
"	Massillon,	"	Collision and eruption of steam.
"	Tennessee,	Cumberland river.	Burnt and sunk; passengers saved.
Nov.	Wilmington,	Mississippi,	Explosion; nineteen killed or wounded.
1840	Gallatin,	Cumberland river,	Collapse; three scalded.
,	Lexington,	Long Island Sound,	Burnt; about 124 lives lost.

"It may be seen that the most numerous and fatal of the accidents by steam have happened soon after the semi-annual inspections of the first of April and October. This fact will not appear surprising to practical men; who fully understand that the care and skill of official inspectors, cannot be advantageously substituted for the uncontrolled vigilance and practical knowledge and skill, of those who are in the constant care and superintendence of the boats and engines; and to whom a good reputation, the desire of safety and the love of life, afford stronger and more efficient motives to correct action, than can ever be furnished by the requirements or penalties of special enactments of the legislative power.

"The Cincinnati Gazette is stated to have published a list of steam boat disasters on the western waters during the last year. The sum total of losses is 40; of this number, 32 were an entire loss; snagged, 21; struck rocks, or other obstacles, 7; burnt, 5; burst their boilers, 4; run into other boats, 3—40. There were snagged on the lower Mississippi, 11; on the Missouri, 4; on the Ohio, 4; on the Yazoo, 1; on the Red River, 1. It is remarkable that a majority of the boats were snagged on their downward trips. Lives lost, by bursting boilers, 39; by other causes, 6. Total, 45. The amount of property destroyed in boats and their cargoes, is supposed to be not less than a million of dollars.

"On events like these, the provisions of statutory law can have but little influence; except as they may operate to deter the men of means, foresight and mental ability, from a business already too hazardous to their private interests, and which, most unwisely, has been made subject to the proscriptive action of the popular press, and of the national legislature."

Another extract gives a more powerful lesson.

"That the safety of steam boilers from explosions, does not necessarily depend upon working with so low a pressure as five or seven pounds to the square inch, and that a reasonable increase in the proportionate strength of the boilers in steam vessels would remove all immediate hazard, and nearly end the catalogue of these disasters, is rendered apparent by the facts which relate to this branch of navigation, as it has been carried on in various directions from the city and port of New York. Here, where steam navigation was first successfully established, and where it has probably attained its highest degree of efficiency, we might have expected that accidents and disasters would, not unfrequently, attend the use of a power at once so novel and energetic. The accidents and fatalities which have here occurred, as well as their probable proportion to the pressure of steam, the number of boats employed or trips made, the number of miles navigated, and the number of passengers which from time to time have been exposed, are set forth in a table.

"The table, so far as relates to the service performed on the different routes and the number of persons exposed, is made up approximately, by estimates founded on my general acquaintance with our steam navigation; but is believed to be sufficiently correct for general purposes. I have separated the business of the fifteen years which it comprises, into three several periods of five years each, commencing with 1824; early in which year the navigation, in this state, which had previously been controlled by the associates of Fulton and Livingston, was thrown open to all competitors.

"It appears from the average results of the table, that during even the first period of five years after the navigation was thrown open to public competition, the ratio of steam accidents was only equal to one, for more than 20,000 trips or passages; and that the average loss of life was only equal to one, for more than 126,000 passengers exposed. Thus, at the fair outset of this noble enterprise, a degree of safety was attained for the passenger, such as may well challenge comparison with any artificial means of transit or locomotion that have ever been resorted to by the human race.

"It appears further, on comparing the results for these several periods, that the ratio of steam accidents for the first and third periods, as compared with the probable number of trips made, has decreased from one in 20,317, for the first period, to one in 317,105, for the third or latest period; showing a diminution of the ratio of accidents in the average period of ten years equal to *about* 84 *per cent*. The ratio of lives lost from these accidents during the same period, has also decreased from one in 126,211, to one in 1,985,787; equal also to a diminution in the ratio of personal hazard, in this short period, *of* 84 *per cent*.

"It appears also from the table, that during the first of these periods the average number of miles navigated by all our steam boats, to each explosion which occurred, was equal to 235,646: a distance equal to many times the circumference of our globe, and about equal to that from the earth to the moon. But even this ratio has been rendered tenfold more favourable in the short average period of ten years, being for the latest five years, 2,733,725 miles navigated for each explosion; or more than eleven times the distance from the earth to the moon; and reducing the ratio of hazards in proportion to distance, *almost* 90 *per cent*.

"This remarkable diminution of accidents and hazard, it may be seen, has taken place in the very period in which the average working pressure of steam has been more than doubled. It has also been attained solely by professional skill and experience, and without any aid from legislative interference; for the law of Congress on this subject was not in force till near the close of the year 1838. Had such a system of legislation been at first adopted, there are sound reasons for concluding that it would not have prevented disasters, but might have greatly retarded the rapid advance in safety, as well as improvement, which has been so happily attained."

It is thus seen that with an increase of pressure a decrease has taken place in the number of casualties, In the first period the estimated average pressure was 7 lbs.; in the second period 14 lbs.; and in the last period 18 lbs.

We cannot conclude this better than by laying before our readers the eloquent vindication of Western steam navigation, which was given before Congress by the Hon. Mr. Rumsey, of Kentucky.

"Sir, you have no arithmetic of powers vast enough, by which to estimate the benefits of the steam boat in a pecuniary point of view alone. Its labours, too, have tended, in no small degree, *to the preservation of human life.* I am aware that the truth of the last assertion may not be universally admitted; but it will scarcely be questioned, at least by a western or south-western man, who recollects the old mode of conducting our commerce. Small as the commerce was before the introduction of the steam boat, it drew off a larger portion of the population than is now necessary to transact it, although so immensely extended. Even then, more died in the long, and exposed, and laborious voyages in keels and barges, or the exhausting return by land, under a vertical sun, than now perish by steam boat explosions. But they dropped off one by one; they sank obscurely into the grave by the wayside; or, after reaching their homes, fell victims to disease incurred by a sojourn and travel in southern climes. The consumption of life, though known to be great in the aggregate, happening so much in detail, made no public impression. But now, every steam boat accident creates a sensation, and is proclaimed in the universal press of the country. If the mighty commerce now in progress on the western waters, had to be conducted in the old way, it would require the agency of so many individuals, that it would not be long before the sides of the public roads from New Orleans to the Upper States, and the banks of the great river which pours into the gulf the congregated waters of nearly half a continent, would be almost continued grave-yards."

NOTES OF THE MONTH.

This month has been more fertile in deaths than in any thing else. In this number is Thomas Drummond, Lieutenant in the Royal Engineers, F.R.S., Under Secretary of State for Ireland, &c. His labours in the Ordnance Survey of Ireland, and his discovery of the hydro-oxygen light, which bears his name, are well known to the public. As an Irish Railway Commissioner it was our lot to oppose him, but we are free to confess that it was to Drummond that the report was indebted for its most valuable portions. He died on the 18th ult., at Dublin, and was honoured with a public funeral, which he highly merited.

Pitts, the sculptor, unfortunately committed suicide on the 16th ult., in his 50th year. He was an artist of high merit, who it is to be hoped will receive that honour now which he pined for in his lifetime. Among his works are the Shield of Eneas, from Virgil, and that of Hercules, from Hesiod, compositions and designs from Virgil and Ossian, intended to be published in the same form as Flaxman's from Homer, the Nuptials of Perithous, the Apotheosis of the English poets, and several other reliefs which adorn Buckingham Palace. The Brunswick Shield was another of his works.—The Chevalier Gasse is also dead. He was architect to the King of Naples, Corresponding Member of the French Institute, and of the Institute of British Architects.

The Easter holidays have given some check to business, so that we have little to record. Spencer's Electrotype is now receiving the attention which it deserves; some months ago it was smothered under the blaze of photography. Seals and copies of medals are made by this means with great accuracy and celerity.—Jacobi's galvanic engraving is also acquiring publicity. We may mention by the bye that as his other electric inventions have not exceeded those of our countrymen, so his application of electro magnetism as a motive power is derived from an Englishman.—Smee's battery described in our present number will give fresh power to the professors of this important branch of science.—Claudet and Houghton's specimens of Daguerre's process of photography now exhibiting in Holborn, are well worthy of inspection, they give good earnest of the aid this admirable invention will afford to the arts. Its application to the delineation of architectural and antiquarian subjects will make it of great value to the profession. The Elgin marbles should be copied by this method.

The vacuum engine is the wonder next to be exhibited; a new application of agriculture, by which it is said, above twenty square miles can be cultivated by one stationary engine has been patented, and will be shown to the public on a small scale early in the ensuing month.—It will be recollected that Hague's draining apparatus is on this plan, and a steam engine erected by Mr. Hague at Constantinople, works a powder mill seven miles off, at a place where the Grand Signor refused to allow any steam engine to be erected within that distance.—Mr. Maugham, the lecturer on chemistry, has removed from the Adelaide Gallery to the Poletechnic. At this latter Institution an ingenious application of propellers to the balloon is shown, although their success on a large scale is doubtful, from their incapacity to contend with currents of air.

The plan for embankment of the Thames is now before the legislature, so that we may expect something as a beginning.—The wood pavement companies are getting on faster than the asphalte, they are at work at Buckingham Palace, in the Strand, Oxford Street, St. Giles's, and Lamb's Conduit Street The elasticity of this material forms one of its best properties. Under most of these pavements a firm bed of concrete mixed with Roman cement and puzzolano is laid, rather expensive we should think.

The Marine Gallery at Hampton Court Palace was opened on Easter Monday, so that the maritime nation has at last two marine galleries.—The Government School of Design at Somerset House has made another step out of the humdrum system; having obtained a set of casts from Messrs. Lofts in Dean-street. How they could persevere in their exclusion of the figure, it is difficult to conceive; they have only to go into their own schools and look at the drawings of the same ornaments affixed to the walls; those from casts are full of life and spirit, and in high relief, those from engravings more laboured are dead and flat. In fact the wisest thing they could do would be to turn every engraving out of the school, where they can substitute nature or casts, and above all never to let a boy begin to draw from a drawing,—set him before the Apollo or the Venus at once. This has been tried at the Leicester-square school with full success, even on its very young boys. The latter is far before Somerset House in principle; thanks to their badly remunerated Director Mr. De Mouchet. The modelling class at Leicester-square gets on well. We hope the inspection of Mr. Wyse at Somerset House last month will do some good; that patron of the arts has, it is said, suggested many modifications in the establishment. One fruit of his visit is a report from the council, the first since their institution. Pretty fair from a national establishment! It is a pity these establishments are not more frequented, where the working classes can obtain first rate instruction in the arts for *sixpence a week*. The whole number of students at the school is not more than two hundred.

Pneumatic Experiment on the Birmingham, Bristol, and Thames Junction Railway.—The engine-house is built, and the communicating tube between it and the railway, by which the exhaustion of the main tube is to be effected, is nearly laid. The permanent way and rails are also almost completed, and fit for the laying down of the tubes for a considerable distance out of the 1¼ miles on which the experiment is to be made. We perceive also that a great many of these tubes are already arrived and on the ground. They are nine inches diameter, and are lined inside, to about the tenth of an inch thick, with a hard unctuous substance, much resembling, in its disagreeable and suffocating smell, hard tallow. The slit or aperture of the tubes through which the arm communicates with the running piston and the carriages is about 1⅜ inch. We understand, if the experiment be successful, the company are to have the use of the patent gratis, for devoting the road to the trial, and are to purchase the whole apparatus and preparations at cost price; and if it does not succeed, all is to be cleared off within a given time. Supposing the experiment effects all that its advocates expect, we cannot see the use of so small an apparatus in such a place. If we remember right, the inclination of the road, about that part, is 120 feet a mile; therefore, the traction is more than three times that on a level, or above 24 lbs. to the ton. But a circular tube 9 inches diameter, fully exhausted, and exclusive of all friction, would only draw about 954 lbs., or, at 24 lbs. per ton, under 40 tons. The probability, however, is, that it will never in that length be half exhausted; so that the absolute load it would take would be under 20 tons, carriages, load and all, assuming a perfect absence of all friction in the machinery. We shall, however, be much surprised, if the useful effect is anything like this. Our opinion is, that the patentees have made the apparatus much too small for any useful purpose upon such a road, and also for the purpose of showing off the invention well, assuming it to be all that can be expected of it. A few days ago the works were suspended, in consequence of a dispute between the Messrs. Samuda and the contractors, about the point of delivery of the tubes —that is, whether it should be a few yards on the north, or a few on the south of the crossing of the Great Western line. Where so much is involved as here, this dispute is equally as ridiculous as that of the Lilliputians and their neighbours, about which end eggs ought to be broken.—*Railway Magazine.*

Galvanic Engraving.—It is not generally known that the method of producing fac-similies of engraved plates by means of voltaic electricity, as indicated by Mr. Brande, Mr. Faraday, and Professor Jacobi, has been frequently demonstrated with complete success by Bachhoffnor, of the Polytecnic Institution, in Regent-street, at which establishment many satisfactory specimens may be witnessed. The process is as follows:—The plate from which the duplicate is to be taken is first placed in a vessel properly adapted for the purpose, and is then covered with a solution of sulphate of copper, through which the galvanic stream is transmitted. This causes a decomposition, or, in other words, the constituents of the salt are removed from each other, the metallic copper resulting from the action being deposited in a series of thin laminæ upon the original plate. This deposited copper forms a second plate, which, on removal from the other, exhibits every line and mark traced by the graver or etching-tool upon it, with this difference, that what is bas-relief in one is alto-relief in the other, and the engraved lines of the original are raised lines in the duplicate. The sheet of copper thus produced becomes a normal plate or mould; from which, by a similar process, an *ad infinitum* number of plates may be taken, in every respect equal to the original, and capable, like it, of giving perfect printed impressions. The value of this practical discovery is great, inasmuch as it will supersede the necessity of expensive steel-plate engravings, by multiplying copies of those on copper plates at the cost of a few shillings and loss of a few days only. Impressions from medals, coins, and dies may be obtained in the same way, of which there are several specimens in the gallery of the Polytecnic Institution, as well as a very large duplicate copper plate of an elaborate engraving from one of Domenichino's pictures.

ON BLASTING LIMESTONE ROCK.

Some Account of Blasting the White Limestone in the County of Antrim, in Ireland. By WILLIAM BALD, F.R.S.E., M.R.I.A., &c' *Read before the Institution of Civil Engineers.*

IT becomes necessary to make a few short observations which may perhaps be interesting to the scientific engineer. Along the north coast of Ireland from the Bay of Belfast to Lough Foyle, the country consists of white limestone; columnar basalt, and some conglomerate sandstone; but the hill of Carey consists of mica slate; and is of the same formation as the Mull of Cantire, a part of the coast of Scotland lying opposite. The geologist can here easily trace the connecting link in the formation, which joins the two countries, although a channel 90 fathoms deep separates them. Numerous whin dykes intersect the strata along this part of the Irish shore, they run nearly parallel to each other in some cases, and are very remarkable in their structure.

The study of the peculiar qualities of the respective rocks and strata, and their position and inclination, will enable the engineer to work them in a more scientific manner. And in the construction of harbours, lighthouses, lines of navigation, drainage, roads, &c. &c., an intimate acquaintance with the component parts of the rocks will enable him to select those best suited to resist the action of time, whether they be placed under the dominion of the deep, exposed to the ravages of the pholas, or subject to perhaps the more wasting influence of the atmosphere; by such studies his skill will be alike visible in the selection of the best material for the repaving of even a common road, as it will be for that of the most splendid edifice destined to survive ages.

In constructing the Antrim coast road it became necessary to cut through extensive and high masses of white limestone; one of the sea cliffs in the Little Deer Park, near Glenarm Town, extended to a length of nearly one thousand yards, rising from twenty feet to about two hundred in height, washed at its base by a deep sea, and entirely exposed to the run of the ocean in the north channel.

Above the white limestone is situate the columnar basalt, but no part of the road was cut through this last mentioned rock. The white limestone in Antrim differs from the chalk in England, in being more indurated, while in other respects it is similar to it in the quantities of flint it contains. This rock is close and fine in its texture, but it is deeply fissured in many directions; the scull veins it exhibits are extremely curious.* The inclinations of the limestone strata on this part of the coast does not in general exceed 15° dipping into the land. Under the lime rock strata lies the brownish red coloured sandstone.

In blasting down those lofty cliffs of white limestone, the borings were always made into the toe of the rocks, and were so arranged that the line of least resistance should not be in the direction of the line of boring. Hundreds of tons of rock frequently rested on a base of a few superficial feet, which being blasted away, the cliff above tumbled down. The patent safety fuse was used, and which was attended with the most beneficial results, copper tubes for putting in the charges, and also copper needles.

During three years operations not a man was lost, although upwards of one hundred thousands tons of limestone were blasted down upon less than one mile of the road.

The following are the results of a few experiments made upon loose detached blocks of white limestone at Glenarm, Little Deer Park.

	Cubic feet in each block.	Quantity of powder used.	Cubic feet for each ounce of powder used.
Block No. 1.	165	12 oz.	13·78 ft.
2.	180	12 oz.	15·00
3.	540	38 oz.	14·21
4.	864	64 oz.	13·50

From the above experiments it took one ounce of gunpowder to rend asunder 14·12 cubic feet of the white limestone when in blocks. And from experiments made on the solid loose whinstone blocks, it took about one ounce of gunpowder to blast asunder 11·75 cubic feet.

Three experiments assigned the specific gravity of the white limestone at 2,747, 2,769, 2,763; and the whinstone or basalt at 3,200, being about 13 cubic feet of white limestone to the ton, and 11·20 cubic feet of the whinstone to the ton.

TABLE OF THE WORKING PROCEEDINGS.

	Depth of boring.	Quantity of powder.
An auger of 1¼ inch diameter.	15 inches deep.	6 inches.
Ditto 1½ ditto	26 ditto	8 ditto.
Ditto 1⅞ ditto	30 ditto	9 ditto.
Ditto 1⅞ ditto	36 ditto	12 ditto.
Ditto 1⅞ ditto	48 ditto	17 ditto.
Ditto 2 ditto	5 feet	20 ditto.
Ditto 2 ditto	6 feet	27 ditto.

The above table exhibits the diameter of the auger or jumper used, the depth sunk, and the number of inches of gunpowder* put in.

The force of the explosion of gunpowder is assumed to be as the cube of the length of the line of least resistance, thus if one ounce of gunpowder will open a distance of one foot of rock, the table would run thus:—

Line of least resistance.	Charge of powder exclusive of priming.
If 1 foot of rock requires	1 ounce.
2 feet would require	8 ditto.
3	27 ditto.
4	64 ditto.
5	125 ditto.
6	216 ditto.
7	343 ditto.
8	512 ditto.
9	729 ditto.
10	1000 ditto.

I am aware there is much difficulty in knowing exactly where the line of least resistance is, because the rock may be fissured, or some bed or opening may be near to the line bored, and this is the case where the rocks are stratified; but the hypogene rocks, such as granite and syenite, lying in large solid compact masses unstratified will be different, and these rules may be usefully applied. In blasting asunder loose detached blocks, a much greater quantity of material will be blown asunder by the same quantity of gunpowder than of rock lying in close connected beds.

It is always desirable to work the rock out by the dip of the inclination of the strata, or as the quarrymen call it, the going way of the rock.

In the white limestone quarries lying in the high ground north of the town of Belfast, where the limestone is quarried for building and agricultural purposes, and also for export; two men will quarry out at an average from eight to ten tons per day, the augurs or jumpers generally used are 1⅝ inches, and two inches diameter; and the induration of the white limestone may be estimated when two men will bore one foot deep in half an hour; they generally put in about three inches of powder for 15 inches deep, and 6 inches for about 2 feet deep; the expense for quarrying is about from fivepence to sixpence per ton. There are nearly 13 cubic foot of the white limestone to the ton, which is at the rate of nearly about one shilling per cubic yard. This white limestone is much esteemed in Glasgow and all the towns on the Clyde, where it sells for five shillings per ton—but the quarrying works near Belfast are carried on in a very limited manner, or rather on a very small scale.

Numerous experiments made by military engineers assign the force of the explosion of gunpowder to be as the cube of the length of the line of least resistance. Vauban and Belidor,† both of them excellent mathematicians, and also possessing great practical skill, ingenuity and experience, investigated this subject, doubtless more particularly with a view to the operations of war, than to those of the works of the civil engineer. The law of the explosive force of gunpowder remains the same in all the various forms it may be applied to matter, whether in blasting out of rock or earth, or the destruction of the masonry of fortifications by blowing them up, or laying in ruin bridges built over large and deep rivers to arrest the progress of hostile armies.

The total cubical contents of the four blocks of limestone given above, amounted to 1749 cubic feet, and the quantity of powder used 126 ounces, being at the rate of 1·94 ounces for each cubic yard blasted asunder. But if the rate per cubic yard be deduced from the quantity of powder expended on each block, then the following will be the results obtained from the four experiments.

---

* The grey limestone with which the Light-house of Clare Island is built is much traversed by scull veins, and water enters them during severe rain storms.

* One pound of gunpowder occupies 30 cubic inches.

† Belidor, one of the most scientific of the French engineers, has given the following rule for finding the charge of a surcharged mine or globe of compression, "is to multiply the length of the line of least resistance in feet by 00, and the product will be the weight of the powder in pounds."

165 cubic feet was blasted asunder by 12 ounces of gunpowder, which is at the rate of 1·96 ounces of powder for each cubic yard.

180 cubic feet was blasted asunder by 12 ounces of gunpowder, which is at the rate of 1·80 ounces of powder for each cubic yard.

540 cubic feet was blasted asunder by 38 ounces of gunpowder, which is at the rate of 1·90 ounces of powder for each cubic yard.

864 cubic feet was blasted asunder by 64 ounces of gunpowder, which is at the rate of 2 ounces of powder for each cubic yard.

Therefore in the large loose limestone blocks about 2 ounces of gunpowder may be taken as the expenditure being necessary to blast out each cubic yard. The four blocks on which these experiments were made, were not at all cubical, although the one which contained 540 cubic feet was nearly so. From the above results I beg to submit some calculations regarding the force of the explosion of gunpowder, being as the cube of the length of the line of least resistance.

We are in possession of the quantity of gunpowder used in blasting the four blocks, and also of the solid feet contained in each of them. Extracting therefore the cubic root of the cubical contents of each block, we shall then have their masses all in cubical form as follows:

Cubic feet in each block.			Side of the cube.
$\sqrt[3]{165}$	-	-	5·484
$\sqrt[3]{180}$	-	-	5·646
$\sqrt[3]{540}$	-	-	8·143
$\sqrt[3]{864}$	-	-	9·524

Taking the length of the line of least resistance at each of these cubes to be equal to the distance from the centre to the nearest point on the surface, or equal to half the side of the cube, then the following will be the lengths in feet of the lines of least resistance.

In cube No. 1 — 2·742 feet.
No. 2 — 2·823
No. 3 — 4·071
No. 4 — 4·762.

The quantities of gunpowder consumed to blast asunder a line of least resistance, of

2·742 feet was	12 ounces,	165	cubic feet blasted asunder.
2·823	-	12 ditto,	180	ditto.
4·071	-	38 ditto,	540	ditto.
4·762	-	64 ditto,	864	ditto.

If 165 cubic feet be blasted asunder by 12 ounces of gunpowder, the line of least resistance in that mass, if in cubical form, will be

$$\sqrt[3]{165} = 2{\cdot}742 \text{ feet.}$$

Then the line of least resistance for one foot in cubical form will be equal to 8 cubic feet. Then if 165 cubic feet with a line of resistance of 2·742 feet require 12 ounces of gunpowder to open it, then 8 cubic feet with a line of resistance of one foot will require 0·582 ounces of gunpowder to open it asunder.

The following are the quantities of gunpowder required to open one foot of least resistance through the white limestone, as determined by the blasting of the four blocks.

Cubic feet in each block - - -	165	180	540	864
Quantity of powder used to rend it asunder, in *ounces* - - - -	12	12	38	64
Cubic feet opened by the line of resistance of one foot - - - - -	8	8	8	8
Quantity of powder required to open the line of least resistance of one foot, in *ounces* - - - - - -	0·582	0·533	0·563	0·593

Mean 0·568 oz.

Apply the rule of the cube of the length of the line of least resistance, and working with the element just obtained from the four experiments, to open asunder the line of least resistance of one foot.

No. 1—Then the scale of the length of the line of least resistance in No. 1, $2{\cdot}742^3$ feet multiplied by 0·582 ounces, the quantity of powder to open one foot will be $2{\cdot}742^3 = 20{\cdot}62 \times {\cdot}582 = 12$ ounces.

No. 2—For a line of least resistance of 2·823 feet will be 11·95 ounces, $2{\cdot}823^3 = 22{\cdot}42 \times {\cdot}533 = 11{\cdot}95$ ounces.

No. 3—For a line of least resistance of 4·071 feet, will be 37·97 ounces, $4{\cdot}071^3 = 67{\cdot}45 \times {\cdot}563 = 37{\cdot}97$ ounces.

No. 4—For a line of least resistance of 4·762 feet, will be 64 ounces, $4{\cdot}762^3 = 107{\cdot}983 \times {\cdot}593 = 64$ ounces.

It is therefore clear from these experiments made that the force of the explosion of gunpowder is as the cube of the length of the line of least resistance. Taking the mean quantity of gunpowder obtained from the four experiments to open asunder a line of resistance of one foot, and which is 0·568 ounces. The following will be the results calculated according to the cube of the length of the line of least resistance.

$$2{\cdot}742^3 = 20{\cdot}62 \times 0{\cdot}568 = 11{\cdot}71 \text{ oz.} = 165 \text{ cubic feet.}$$
$$2{\cdot}823^3 = 22{\cdot}42 \times 0{\cdot}568 = 12{\cdot}73 \text{ oz.} = 180$$
$$4{\cdot}071^3 = 67{\cdot}45 \times 0{\cdot}568 = 38{\cdot}31 \text{ oz.} = 540$$
$$4{\cdot}762^3 = 107{\cdot}983 \times 0{\cdot}568 = 61{\cdot}33 \text{ oz.} = 864.$$

In having described the mode of blasting the white limestone on the Antrim coast road in the north of Ireland. It may be useful as well as interesting to the engineer to describe its qualities, and to what extent it may be employed in the construction of works.

In treating of the nature of any kind of material to be employed in building, the first consideration is its character, to resist decomposition whether placed in the open air exposed to the full action of the atmosphere, or buried in the earth, or entombed in the deep. Its induration and compactness of structure, the absence of figures, the mass it can be had in, and the facility of working or tooling it into form.

The white limestone on the Antrim coast road lies in beds dipping slightly to the plane; it is generally quite white, but sometimes it is of a yellowish tint; it is traversed by very small veins of calcareous spar, but the most remarkable feature is the quantity of flints it contains, they are dry, grey and black; the thickness of the beds of the white limestone is very singular, being sometimes more than 30 feet.

This white limestone is not good for building, because it moulders by exposure to the atmosphere, it is not therefore generally used in any public building, although it might be used in filling up the interior parts of walls: it is inferior for road metal, being tender and wearing quickly; it can be procured in large masses, when reduced to pieces containing six, twelve and eighteen cubical inches, it breaks into irregular fragments with sharp edges.

The white limestone when placed under the sea is particularly subject to the ravages of the pholas, and is therefore unsuitable to be employed in the construction of marine works, such as harbours or breakwaters, &c., it is however a valuable material for making lime for building, and for agricultural purposes. In our quarrying operations we rarely found in it shell remains.

In quarrying it out in large masses, the blocks sometimes had what the workman call a lean and a full bed: the lean bed being less than an angle of 90°, and the full bed more than 90°. The white limestone can be split with plug and feather, or pooled by wedges; if the stratification be in thin beds, it opens across with a very rugged and irregular face, but if very solid and compact, and the beds of great thickness, it will open more evenly and equal in the face. It dresses readily with the hammer, and can be wrought and hewn into any form. I am however of opinion that the white limestone of the county of Antrim should not be used in constructing any work requiring durability, because it is a rock liable to decomposition when exposed to the atmosphere.

I have already, in the paper on blasting the white limestone, alluded to the small fissures which traverse that rock, and which also traverse the blue and grey limestone of Ireland, and which the stone-cutters call scull veins doublers, on account of their exact resemblance to the sutures in the human scull.

In concluding, I beg to mention that there are several species of the Pholas. Lamarh in his natural history, mentions the Pholade Dactyle or Pholas Dactylus, as being very prevalent on the coast of France, and also inhabiting the shores of the British seas. I have given a sketch of the Phoylas Dactylus, and I beg to present to the Institution a very beautiful specimen of this kind, from which the sketch has been made, and which specimen I have accidentally obtained in London. There is another species called the Pholade Scrabrelle, or Pholas Candida, which inhabits the European seas, and a very small kind called by the French Saxicave Ridée, Saxicava Rugosa. It is quite foreign to the object of this paper to enter into any thing like giving an account of all the various kinds of Pholas, or their habits; it is quite sufficient to the engineer to know that every description of calcareous rock, when placed under the sea, is subject to be perforated by those bivalves; indeed every rock upon which acids act are subject to be destroyed by them, and it consequently has been conjectured that they possess the power of producing an acid that decomposes the rock containing calcareous matter; on the other hand some maintain this is not the case, because the acid would also decompose the shell which covers them. Mr. Lonsdale, of the Geological Society, mentioned to me that some marine works constructed at Plymouth were much injured by the ravages of the Pholas. Beds of calcareous rock of several feet in thickness, in the Frith of Forth have been entirely destroyed by the Pholas.

It will be seen that the shell of the Pholas Dactylus, presented to the Institution, is very tender and delicate; from the extreme fragile nature of the shell it would not be supposed capable of destroying indurated marble. The external surface of the shell is rough, and radiated transversely and longitudinally in a most beautiful manner by curved lines of a high order; an attentive study of the mere lined surface of the shell cannot fail to be instructive even to the man of science, and worthy to be contemplated and examined by all those engaged in the works of art and taste. The marine engineer may derive instruction from the parabolic curves delineated, and traced out by the hand of nature on the Pholas shell, in assisting him in giving the best shape to the slopes of breakwaters, and harbours constructed in the deep sea, and exposed to the run or momentum of the ocean. The curved radiation or fluting on the shell cannot fail to attract the architect engaged in the works of design and taste. It ought not to be forgotten what struck Watt in examining the joints in the tail of a lobster; nor of Smeaton in looking at the form of an oak tree; nor the falling of an apple which gave the impulse to the genius of a man justly the glory of our island, and whose name stands recorded with the proudest triumphs in the loftiest branches of science that has yet adorned the efforts of human ingenuity.

William Bald.

ENCROACHMENTS OF THE SEA AND FORMATION OF SHORES.

Sir—Public attention has of late years been much engaged by the phenomena observed upon the ocean. The tidal theory, currents, storms, &c. have each been subject to the closest scrutiny, and the result has been much valuable information connected with them. The recovery of land, and the encroachment of the sea, have been for some time, and are now subjects of great interest to the scientific world; this has induced me to request the insertion of the following few lines in the columns of your valuable journal.

The northern shore of the Bristol Channel from the port of Cardiff up to Gloucester consists of a vast flat of Moor land, varying from 1 to 1½ miles in breadth; the soil is composed of a very tenacious clay mixed with shells and a large portion of decayed vegetable matter. This tract is formed totally from the deposit of the waters of the Severn and Bristol Channel. This fact is inferred from the following circumstances:—1st. The soil above described commences about a mile and a half inwards, where its section presents a depth of about a foot, under which is found the natural soil of the country, a yellowish clay intermixed with gravel; from this point it gradually deepens to high water mark, where the depth averages from 35 to 40 feet. 2nd. If a plate or any other body, having a flat surface, be exposed on the shore, between high and low water mark, for a single tide, a deposit will be found thereon varying in thickness according to the calmness of the sea during tide, as it has been observed that the deposit is much increased in stormy wheather when the sea is violently agitated. 3rd. In excavating the Bute Docks the rudder of a ship was found about 10 feet below the surface, the iron work of which was in excellent preservation. It was at first supposed that it had sunk down by its own weight, but its peculiar shape, and the closeness and tenacity of the soil, at once indicate the fallacy of such an opinion; several oak trees were also found about 30 feet below the surface, and about 100 yards above high water mark, these were of sufficient hardness to admit of their being worked up into chairs, boxes, &c.

Fig. 1. Fig. 2

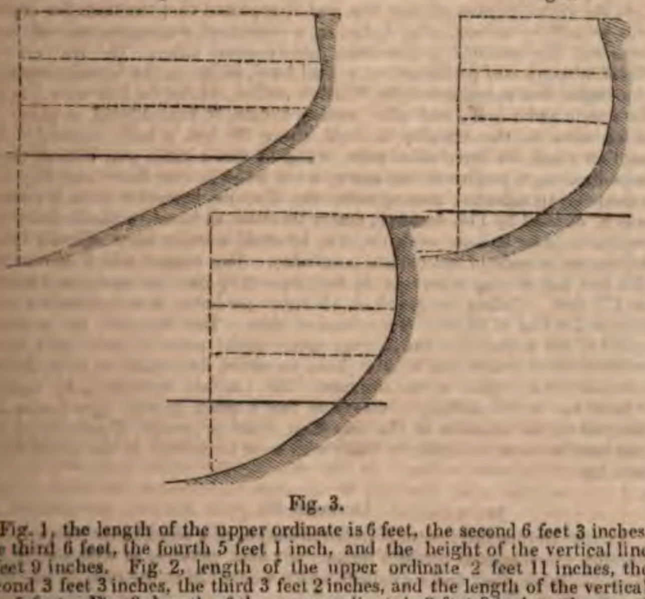


Fig. 3.

Fig. 1, the length of the upper ordinate is 6 feet, the second 6 feet 3 inches, the third 6 feet, the fourth 5 feet 1 inch, and the height of the vertical line 5 feet 9 inches. Fig. 2, length of the upper ordinate 2 feet 11 inches, the second 3 feet 3 inches, the third 3 feet 2 inches, and the length of the vertical line 5 feet. Fig. 3, length of the upper ordinate is 3 feet 8 inches, the second 3 feet 9 inches, the third 4 feet, the fourth 3 feet 7 inches, and the length of the vertical line 5 feet 5 inches. The lower line is the height of high water and spring tides.

These facts, I presume, fully warrant my assertion that the shore is a deposit, and if so, it only remains to discover the cause, which appears to me to be as follows:—In many seasons when the Severn is swollen into a most impetuous and rapid torrent, vast quantities of the rich soils of Hereford, Gloucester and Worcestershire are washed down by it, and the particles prevented from sinking by the rapidity of the current, they are thus carried along until the stream is impeded in its progress by meeting the flowing tide, which runs in this channel with a velocity of from 5 to 6 miles an hour; the tide being the more powerful of the two currents, and having a set towards the south-east, pushes the other current over towards the nothern shore, where the water almost stagnates and the particles settle to the bottom. I am borne out in this opinion by the fact that there is but little current in the space between high and low water mark, a distance of about a mile, and which always sets to the westward whether the tide be ebbing or flowing.

At the high water mark the shore suddenly drops about six feet perpendicularly, the profile of the land at this part is exceedingly curious, and accompanying this paper I have sent a few sections taken at the more prominent parts, and consequently most exposed to the force of the wave. I think some very valuable hints might be taken from them in the construction of piers, sea walls, and other works exposed to the action of the sea. These sections were taken with much care, and may be fully relied on for accuracy.

I remain your most obedient servant,

NOTA.

ENCROACHMENTS AND RECESSIONS OF THE SEA.

[The following article is from the *Cinque Ports Chronicle* of February last, it is a reply to a paper which appeared in the Journal, page 64, for February last, under the signature E.]

We regret that "E," while he questions the accuracy of our theory, has not started some tangible objection for us to grapple with, and as he has not done this, we must content ourselves with a reference to some additional facts in corroboration of the view we hold of the subject. We find that as the projections of the Hastings cliffs are diminished, additional deposits of beach are formed in the West bay, gradually augmenting also at Dungeness Point, the extremity of the curve described by the sea, on account of the land, though low, consisting, we believe, of chalk or other formation, calculated to resist the action of the waves. It is also a fact that, as the Ness point augments to seaward by deposits of beach, the sea has recently made considerable encroachments to the eastward, or side opposed to the prevailing current. Within the last few days also, a temporary headland has been caused about one mile s.w. of Dover, by the fall of an immense quantity of chalk, denominated Round-down Cliff. Now by obstructing the parallel course of the western current, it would, according to our theory, throw the tide in with additional momentum upon the western pier of Dover harbour, and this, we believe, has since been realized, and so effectually as to diminish the bar of beach, which, for some months previously to this accident, had been collecting in serious and unusual quantities. Nature has thus, we conceive, by one of her accidents, demonstrated the means, which our celebrated engineers have hitherto searched for in vain, of preventing the formation of a bar of beach at the mouth of Dover harbour. Viewing that locality in connexion with our theory, we have no doubt that if masses of rock, forming a durable obstruction in the nature of a headland, were deposited at a proper distance from the entrance of the harbour, the artificial promontory would give such a curvilinear and additional impetus to the waves and current, as would tend to pass the beach beyond the east pier of the harbour.

The recent south-westerly gales have, however, contributed events under our immediate observation which, in our humble opinion, have triumphantly established the theory we have broached, and which "E" has not attacked on any specific point. The circumstances to which we allude are the following: a groyne was constructed some few months ago on the beach a little to the westward of the villas between Verulam Place and Warriors' Square, for the purpose of protecting the esplanade wall to the eastward. That it effected by retaining the beach, which effectually repels the inroads of the waves. Here, then, we had a promontory formed on a miniature scale, and it was not long before what we conceive to be the great law of nature, viz., the formation of a bay exactly proportioned to the obstruction caused to the sea by an intervening headland, became too apparent. The waters, interrupted in their course by the beach collected at the groyne, were thrown with an additional impetus to the eastward of the groyne, exactly, we believe, proportioned to the obstruction they had encountered, and after repeated assaults upon the wall, have undermined, washed it, the parade, and part of the road away, clearing out a bay, which, from measurement, we find about the perpendicular length of the groyne, which was the passive cause of the inroad. Had the groyne in question not been erected, although the wall would have been undermined and thrown down by the groyne farther west, at the South Saxon hotel, yet the inroad would have been less considerable; or had the effects of our miniature promontory been diminished, by constructing it on a smaller scale, and neutralizing its *mischievous* tendency by a well graduated line of groynes to the eastward, the inroad would have been prevented. Groynes on this part of the coast are well known to have the effect of saving and protecting land to the westward, and of endangering it unless the groynes be continued to the eastward; this any common observer would satisfactorily demonstrate to "E," and in explaining the grand alterations in the face of the coast, by reference to such miniature causes, we believe, our views are unquestionably substantiated, as far as the encroachments of the sea are concerned; and we are equally confident in the accuracy of our views with respect to the recessions of the sea, that they occur in proportion as the headlands, which, under the agency of the prevailing current, formed bays, are diminished. This would, we believe, be experimentally proved if the groyne, which has caused the injury to the esplanade wall at St. Mary Magdalen's, were reduced in length and height. The sea would throw up beach where it has recently invaded, and there it would remain to an extent exactly proportioned to the diminution of the westerly groyne or headland. Similar reductions have taken place in groynes farther to the eastward, which had been constructed on too large a scale, and their destructive tendency to the eastward thereby reduced in a direct ratio. With these facts, supporting the theory we have advanced for the general cause of the encroachments and recessions of the sea, we must, until "E" succeeds in shaking our data, instead of merely questioning them, assume that we have offered a satisfactory explanation of the interesting phenomena afforded by the alteration of the Southern coast, and, in conclusion, express a conviction that if Beachy Head and the Hastings cliffs were severally extended to the distance seaward that now exists between Pevensey castle and the sea, and also between Winchelsea,* and the present high-water mark, such an elongation of the obstructing headlands would give such an additional impetus to the sea, as to cause it again to wash the base of the hills on which those towns are situated. We have affirmed that the perpendicular line, from the ordinary high-water mark to the furthest discernible inland existence of beach, is equal to the original projection of the headlands beyond their present termini, and we believe it to be correct. We, however, invite inquiry on the subject, as also to the cause of the *regular high-water marks* successively following each other for a considerable distance on Lydd beach; the early ones being covered with green sward, evidently the produce of ages.

RESISTANCE TO RAILWAY TRAINS.

Dr. Lardner recently delivered at the Athenæum, Manchester, a course of lectures "On the resistance of railway trains, the effects of gradients, and the general economy of steam power."

Lecture I.

Dr. Lardner commenced by observing, that it was a strong example of the manner in which practical matters were conducted in this country, that they had been now ten years, with all the extraordinary effects of railways passing under their notice, stimulating their attention and calling up the wonder of all parts of Europe, and yet to this hour the general problem, the solution of which was the actual amount of resistance to railway trains, might be considered to remain, so far as the engineering profession was concerned, without solution.

It was not till a very recent period that, even on common roads, the amount of this resistance had been made the subject of inquiry. An instrument had, however, been invented by Mr. M'Neil, the engineer, who had instituted experiments to ascertain the actual resistance on turnpike roads, which he had found to be about one thirtieth part of the load. Now, the principle was equally applicable to common roads as to railways, that the resistance would be diminished in the proportion in which they enlarged the wheel; but when they increased the size, they also increased the weight, so that there was a practical limit to the diminishing of resistance in this manner. The average resistance which a load placed on a railway offered to the tractive power, was intimately connected with the principle upon which railways themselves were constructed; and this connexion had been largely acted upon by the legislature in all inquiries concerning contested railway bills. It had been assumed in parliament that an engine might be expected to pull a load, with all the necessary expedition, up an inclined plane, provided that inclined plane offered not more than double the resistance which the engine had opposed to it on a level. That had been laid down and acted upon in parliament as a species of standing order. The principle acted upon was, that the resistance upon a level would be about 9 lbs. a ton, and, consequently, an inclination which resisted 1 in 250, was an inclination up which the engine might be expected to work with a full speed. Upon this principle the sections of all the railways in the country had been laid. But the fact was, that the resistance depended upon entirely different principles. In the inquiries which took place, no one ever hinted that the resistance depended upon the speed—no one suspected for a moment that there was more resistance at thirty miles an hour than at one mile an hour. He was quite sure that many would be perfectly astonished at this statement, but it was a fact established by abundant evidence, and innumerable experiments made by philosophers at different times and in different countries, that resistance depended upon friction, and did not depend upon speed; that so far as resistance to any degree depends upon the friction of the axles upon their bearings, or the rolling motion of the tires upon the road, it was demonstrable that the resistance was the same at all speeds whatever, whether twenty, thirty, forty, or fifty miles an hour. Never supposing there was any other cause, they at once assumed that resistance, at all speeds, was either actually or nearly the same. This was the source of the error.

One of the standing orders of parliament was, that whenever a railway had a curve, with a radius of less than a mile, the committee must make a special report of such a curve, upon the supposition that it was attended with increased resistance or danger. The popular idea was, that when the wheels got to the curve, the outer flange of the wheel mounted upon the rail, by the conical form of the tire, while the other fell from off the rail; thus the one wheel acquired a diameter virtually greater than the other; that, therefore, one revolution of the outer wheel, having a virtually greater diameter, would carry it over a greater space than one revolution of the inner wheel; and that the two things would accommodate each other so that the outer wheel gets round a larger portion of the rail, while the inner wheel, being virtually smaller, gets over a smaller space, and that in this way the cone of the wheel accomplished the thing. Never was there a more consummate mechanical blunder. The fact was, the cone had nothing to do with the traversing of the carriage round a curve; and it was entirely the mechanical action of the flange pressing on the rails.

He had alluded to one or two circumstances connected with the practicable and probable speed likely to be attained on railways, and the means by which that speed might be attained. Since the great questions which had been agitated respecting the effect which an increased width of rails would have on railway transit, and the effect which very large drawing wheels, of great diameter, would have on certain railways, the question of very vastly increased speed had acquired considerable interest. Very recently, two experiments had been made, attended with most surprising results. One was the case of the Monmouth express. A despatch was carried from Twyford to London on the Great Western Railway, a distance of thirty miles, in thirty-five minutes. This distance was traversed very favourably, and being subject to less of those casual interruptions to which a longer trip would be liable it was performed at the rate of six miles in seven minutes, or six sevenths of a mile in one minute, or 360-7ths of a mile (very nearly $51\frac{1}{3}$ miles) an hour. He had experimented on speed very largely on most of the railways of the country, and he had never personally witnessed that speed. The evaporating power of those engines was enormous. Another performance, which he had ascertained since he arrived in this neighbourhood, showed that great as the one was just mentioned, they must not ascribe it to any peculiar circumstance attending the large engines and wide gauge of the Great Western Railway. An express was despatched a short time since from Liverpool to Birmingham, and its speed was stated in the papers. One engine, with its tender, went from Liverpool, or rather from the top of the tunnel at Edge Hill, to Birmingham, in two hours and thirty-five minutes. But he had inquired into the circumstances of that trip, and it appeared that the time the engine was actually in motion, after deducting a variety of stoppages, was only one hour and fifty minutes in traversing ninety-seven miles. The feat on the Great Western was performed on a dead level, while, on the Grand Junction, the engine first encountered the Whiston incline, where the line rises 1 in 96 for a mile and a half; and after passing Crewe, it encountered a plane of three miles to the Madeley summit, rising 20 feet a mile, succeeded by another plane, for three miles more, rising 30 feet a mile: yet, with all these impediments, it performed the ninety-seven miles in one hour and fifty minutes, or 110 minutes; consequently the distance traversed in each minute was 97 divided by 110, or $52\frac{10}{11}$, nearly 53 miles an hour—a speed which, he confessed, if he had not evidence of it, he could scarcely have believed to be within the bounds of mechanical possibility. The engine which performed this feat had driving wheels of $5\frac{1}{2}$ feet diameter; their circumference would be $17\frac{1}{4}$ feet. Taking the speed at 53 miles an hour, it was within a very minute fraction of 80 feet in a second of time. This was not the greatest speed of the engine, but the average speed spread over 97 miles, and there could be little doubt that it must have exceeded sixty miles an hour during a considerable portion of the distance. Dr. Lardner concluded by saying, "there was as yet nothing to satisfy us that a much greater speed was attainable by the adoption of the very large scale or gauge of railway which had been thought desirable by those who were interested in the Great Western Line."

Lecture II.

In this lecture the Doctor directed attention to a remarkable line of distinction which existed between inclinations upon railways of different kinds. If, for instance, they had a gradient which would fall at the rate of one foot in a thousand, the train would not roll down, because the gravitation would be insufficient to overcome the mechanical resistance. But suppose the acclivity were increased, so that the gravitation would just balance the friction, that inclination would be what in mechanics was called the angle of repose. The amount of this inclination had been made the subject of much dispute; but it had been generally assumed to be 1 in 250, or at the rate of about twenty feet in the mile. Any inclination greater than this would cause the train to move down spontaneously; and it had been assumed in railway investigations before committees of parliament, that the train, under such circumstances, would double its velocity every second of time. The inevitable conclusion to be drawn from this was, that if they had a steep inclined plane of sufficient length, the consequence would be an indefinite increase of speed till they actually acquired a velocity of 1000 miles an hour. Now, they would after this hardly credit the results which actual experiment gave. Nothing could be easier than the problem to determine the actual resistance from the motion of trains on railways, because it was a matter of easy mathematical calculation to predict what the velocity acquired at the end of the first minute would be, and, according to the rule laid down, that it would be twice as great at the end of the second minute, and so on. By comparing this with the velocity the train actually acquired, the comparison would furnish them with an easy clue. Upon this principle, Dr. Lardner had proceeded in a series of experiments made on the Whiston Plane, which has a fall of 1 in 96. They had four coaches, the gross weight of which was 15½ tons, and these coaches were propelled along the summit level to the brink of the plane, until a velocity of about 29 miles an hour was given to them, and then the engine was detached, leaving them to move down. By means of stakes placed on the side of the line, they were enabled to register the length of time it took to descend every successive 110 yards. They commenced their descent from the summit of the plane at a velocity of nearly thirty miles an hour, which, in a very short space of time, increased to 31¼ miles an hour, and then they found that gravity could do no more for them. Instead of going at the frightful velocity anticipated by parliament, they found they got into the most uniform rate of motion at the third or fourth stake, after which there was no increase of velocity whatsoever; and at this uniform motion they continued to descend till they reached the end of the plane. They submitted this experiment to all possible tests, by increasing the weight of the carriages to 18 tons, but it only gave them an increased velocity at starting of 33¾ miles, the train descending at a uniform speed the remainder of the distance.

---

* Both places are said to have been washed by the sea.—Vide map, &c., "Camden's Britannia."

Upon these experiments Dr. Lardner proceeded to remark—"There is an important thing connected with this which I will briefly explain to you. The force that moves the train down an inclined plane is, as you will see, the gravitation of the weight of the train down the plane. This gravitation would, until altogether balanced by some resisting force, acquire an accelerated motion. So long as the resistance to the descending train is less than the gravitation down the plane, so long will the excess of gravitating force down the plane produce an acceleration of velocity, be it more or less. But as soon as the resistance becomes equal to the gravitating force, then there will no longer be any acceleration; the train will no longer acquire an increasing speed. On the other hand, it will not lose speed; if it did, then the inference would be, that the retarding force exceeded the gravitation; but they acquire an equilibrium, and as soon as the resisting force increases to that point that it is exactly equal to the gravitation, then the motion is uniform. The inference we deduced, therefore, was this:—that at 31$\frac{6}{10}$ miles an hour, the gravitation of this train down the plane of 1 in 96 was equal to the resistance; in other words, that the resistance to that speed was $\frac{1}{96}$ part of the weight. And you will see that a necessary consequence of this is, that a train of equal weight, placed on a level, and drawn along a level at the same speed of 31¼ miles an hour, the resistance which it would oppose to the moving power would be $\frac{1}{96}$ part of the whole load. This alone will show you the extent of the error which these experiments exposed; for the common notion before was, that the resistance in all cases was $\frac{1}{250}$ part of the load, or somewhere about 9 lbs. per ton; whereas it appeared that it was in this case $\frac{1}{96}$ part of the load, or about 23 lbs. per ton; so that the engineer's estimate would be in error to the inconceivable extent of mistaking resistance of 23 lbs. for a resistance of 9lbs. per ton."

Dr. Lardner stated that he had tried similar experiments on the plane of the Grand Junction Railway, which descends from Madeley towards Crewe, at the rate of 1 in 177 for three miles; afterwards descending at the rate of 1 in 265, followed by another descent of 1 in 330. The coaches loaded at 18 tons were moved down this plane in exactly the same way, the wind being fair, and they got a velocity of 21¼ miles an hour, and with this velocity they continued to descend the three planes. On making inquiries of the engine-man, he found that the steam was never cut off in descending these planes, so that, instead of accelerating the engines at a dangerous speed, as was anticipated by the parliamentary committee, they were actually insufficient to propel them at a sufficient speed for the work of the road. The result of all the experiments he made on the Madeley plane was, that he never met with an instance of propelling trains down, with a fair wind, at a speed of more than 23 miles an hour. From a comparison of the experiments made at the Madeley and Whiston planes, Dr. Lardner said, "I made a calculation, from which it appears that in the first experiment of the two trains, that portion of the resistance which is due to friction amounted to 96 lbs. only, while that which is due to the atmosphere amounted to 268 lbs. In the second experiment, with eighteen tons, the portion of resistance due to mechanical causes amounts to 100 lbs., while that which arises from the atmosphere amounts to 321 lbs., at only 33 miles an hour. One of the objections was, that the train was too light, and that no fair inference could be drawn from four carriages. We, therefore, tried trains of six and eight carriages. Several experiments were made down very steep planes—that of Whiston being 1 in 96, and that of Sutton 1 in 89. In the first experiment of six carriages, the wind was against us. Down the plane of 1 in 89, we could not get more speed than 32⅓ miles an hour. At this speed the resistance was equal to the gravitation. But with the wind favourable down the same plane, we got 37½ miles an hour, and a mean of these two would be about 35 miles an hour. On the Whiston plane, 1 in 96, with the wind adverse to us, we only got 27$\frac{8}{10}$, or nearly 28 miles an hour, but with the wind favourable, we got 34 miles an hour, the mean of these being about 31. In both these cases, both on the Sutton and Whiston planes, you see the evident effects of the wind. The mean of the two, in these cases, gives, on a less steep plane, a less velocity than on a steeper plane the mean did in the other cases. It is remarkable, and very satisfactory in confirmation of the former experiment, that we had six carriages in a calm descending the Sutton plane, and what was our uniform speed? 35⅓ miles an hour, the atmosphere being calm. In two other cases down the same plane, with adverse wind, we got a speed of 32⅓ miles an hour; with favourable wind, 37½ miles, the mean of which is 35½ miles; so that in a calm we got a mean between the speed with a favourable and that with an adverse wind. All these harmonies in the results are so many corroborations of the principle which they develop."

LECTURE III.

In this lecture the Doctor explained a variety of experiments made on railways, in order to ascertain the source of resistance. He found that an enlarged temporary frontage constructed with boards, of probably double the magnitude of the ordinary front of the train, caused an increase of resistance so trifling and insignificant as to be entirely unworthy of account in practice. Seeing that the source of resistance, so far as the air was concerned, was not to be ascribed to the form or magnitude of the front, it next occurred to him to inquire whether it might not arise from the general magnitude of the train front ends, top and all. An experiment was made to test this; a train of waggons was prepared with temporary sides and ends, so as to represent for all practical purposes, a train of carriages, which was moved from the summit of a series of inclined planes, by gravity, till it was brought to rest; it was next moved down with the high sides and ends laid flat on the platform of the waggons, and the result was very remarkable. The whole frontage of the latter, including the wheels and every thing, a complete transverse section of the wagons, measured 24 feet square, and with the sides and ends up, so as to present a cross section, it amounted to nearly 48 square feet. The uniform velocity, attained on a plane of 1 in 177, without the sides up, was nearly 23 miles an hour; whereas, with the sides up, it was only 17 miles an hour; so that, as the resistance would be in proportion to the square of the velocity, other things being the same, there would be a very considerable difference, due to that difference of velocity. Then, at the foot of the second plane, while the sides were down, an undiminished velocity remained of 19½ miles an hour, whereas, with the sides up, it was reduced to 8½ miles an hour; so that a very extensive difference was produced. They would see at once, that this was a very decisive experiment to prove that the great source of resistance was to be found in the bulk, and not the mere section or the form, whether of the front or the back of a train; but simply in the general bulk of the body carried through the air. It was very likely to arise from the successive displacements of a quantity of the atmosphere equal to the bulk of the body; or still more probably, from the fact of the extensive sides of the train; and indeed there was little doubt that the magnitude of the sides had a very material influence; for, if they consider what is going on in the body of air extending from either side of a train of coaches, they would soon see what a mechanical power must be exercised upon it. Thus, when a train is moving rapidly, the moving power had not only to pull the train on, but it had to drag a succession of columns of air, at different velocities, one outside the other, to a considerable extent outside the train; and it did more, for it overcame their friction one upon the other; for as these columns of air were at different velocities, the one would be rubbing against the other; and all this the moving power had to encounter. This would go far to explain the great magnitude of resistance found, and its entire discordance with any thing previously suspected.

Dr. Lardner next proceeded to consider the practical bearings which the experiments he had detailed would have on the construction of railways. From these experiments a two-fold fact was deducible: first, there was unquestionably a great amount of resistance, and secondly, this resistance had a material dependence on the velocity; it diminished in a very rapid proportion as the speed was diminished. If, therefore, by slackening the speed, they could relieve the engine from any considerable portion of the resistance opposed to it, they had at once a ground for throwing overboard all the objections which had been raised against sections of railways which had considerable gradients. It was asserted that the resistance was a resistance quite independent of the speed, and that its average amount was quite equal to the gravity down a plane with a fall of twenty feet a mile. Both propositions had been proved to be false. The resistance was not constant; it depended on the speed, and its average amount was equal to a great deal more than twenty feet a mile. The gradient that represented the average resistance, instead of being twenty feet a mile, was probably fifty feet; and instead of having no power of limiting the speed, they had a power to which there was scarcely a practical limit. The lecturer stated that he had been ridiculed for the opinion he had advanced before the committee of the House of Commons, that the Southampton Railway Section, of twenty feet to the mile, was as practically good as that of the Great Western, which was on a dead level. He had made that assertion on the ground that in the descent there would be as much advantage gained as disadvantage to be encountered in the ascent; and, except the inconvenience which would result from the inequality of speed, being at one time fast and at another time slow, there would be no other inconvenience or disadvantage worth mentioning. And, therefore, he did contend that it was an extremely improvident and unwise expenditure to lavish millions in cutting through elevations and filling up valleys by large embankments, and constructing tunnels and viaducts, and all the other expensive works, to obtain a dead level. Experiments had since been made which proved the conclusions he had arrived at to be substantially correct. These experiments had been made by Mr. Wood, the engineer of the Liverpool and Manchester Railway, on the Grand Junction Line. A train of twelve carriages, each weighing five tons, was attached to the *Hecla* engine, the gross load being about 82 tons. This was started from Liverpool to Birmingham, under peculiarly favourable circumstances as regarded the calmness of the day and the state of the weather, the engine being allowed to do its own work, unassisted on the various inclines; the velocity of speed throughout the whole way from Liverpool to Birmingham and back again from Birmingham to Liverpool, was, of course, accurately ascertained, and if the theory which he had endeavoured to develop was correct, they ought to find that the average speed in ascending and descending the inclinations would be nearly equal to the speed they obtained on the level parts of the line. There were several planes along the line, and taking the steepest first, viz. 1 in 177, they ascended that plane at the uniform velocity of $22\frac{1}{4}$ miles an hour, and descended it at the rate of $41\frac{1}{3}$ miles an hour, the average being as nearly as possible $31\frac{3}{4}$ in ascending and descending. The ascent and descent of the other gradients on the line gave the same, or very nearly the same, results—the average speed varying little from 31 miles an hour. There was a considerable portion of the line level, and the speed upon that portion was 31 miles, being just the same, allowing for inevitable small discrepancies, as the average speed upon the inclines up and down the line. The plain inference which Dr. Lardner drew from these experiments was this: that the trains between Liverpool and Birmingham performed their journeys in just as short a time as they would do if the line was a dead level from terminus to terminus. He, therefore, considered it unadvisable to expend money in attaining very flat sections, gradients not exceeding thirty feet a mile being, in his opinion, practically as good as a flat and dead level.

Dr. Lardner next observed that it was inexpedient to lavish money in avoiding curves of a less radius than a mile, as no danger could, he believed, attend a curve having a radius of half a mile, perhaps less. It was, likewise, apparent that it was useless to lavish capital on expedients for greatly diminishing friction; such, for instance, as the adoption of wheels of a large diameter, for it was clear that friction afforded but an insignificant part of the sources of resistance, while, by increasing the bulk of the carriage, they gave a greater frontage, and increased the resistance from other causes. Further, observed Dr. Lardner, it seemed probable that they should not with practical trains attain, in the present state of mechanical science, those extraordinary speeds which they were accustomed to hope for some time since. It was not at all likely that they should ever move at the rate of a hundred miles an hour, for the resistance due to the velocity would increase in so enormous a proportion, that it would become an opponent too formidable for any available power to overcome; still less was it likely that those speeds would ever be obtained with profit. Upon this subject Dr. Lardner remarked, "In some experience of railway travelling, I have never witnessed a speed exceeding 45 miles an hour; I did once accomplish that speed with four coaches, but only for a short distance. Mr. Woods has told me, that he has himself gone 48 miles an hour; but that was not for any considerable distance. Let it be remembered, that great speed might be attained in this way. You may get an engine with plenty of steam; you may screw the safety-valve down so as to get a surcharge of steam; you may put no load on the engine, so as to diminish the resistance; and you may run it down a gradually declining gradient till you exhaust all the steam in her boiler upon a falling gradient. Then, if all these things be done, if the rails be clean, and if a correct account be kept, then there will be no denying that great speed has been attained. But when we speak of great speeds, this experiment, the whole length of the Grand Junction Railway and back, at the average rate of 31 miles an hour through the whole distance, with twelve coaches, was a very respectable performance indeed, in the present state of locomotive power."

Lecture IV.

Dr. Lardner said there were two principles on which railways were generally constructed:—First, by departing as little as possible from the natural surface of the ground, and distributing the inclinations very generally and evenly over the whole length of the line, in which case such power was given to the engine as to make it pull up the requisite loads with requisite speed. Others, on the contrary, proceeded on the principle of concentration, and instead of distributing the inclinations over the entire length, they threw them all into one place, as in the case of the Whiston and Sutton planes on the Liverpool and Manchester Railway, and it followed, as a necessary consequence, that the engines which were adapted for working the greater part of such lines nearly on a level, could not easily draw the loads up the inclination, which must therefore be done by additional engines; but if it had been expedient to make the whole line with inclinations like those of the Whiston and Sutton planes, there would not have been the least difficulty in working it, and those planes would have been ascended with just as much speed as that part of the line was now traversed which was nearly level.

Dr. Lardner next proceeded to consider the source of the power of the engine, the manner in which it was produced, and the mode in which it was adapted to use. They should naturally suppose that an element in engine-making of such vital importance as the quantity of surface which ought to be provided to receive the action of fire, in order to produce a given quantity of evaporation, ought to be known to engineers, but they would probably be surprised to find that even the best engineers were as ignorant of it as themselves. No two of them could agree, and they differed, not only in small quantities, but even as much as 100 per cent. Another thing of importance was the magnitude of the grate. Some held, that a square foot of grate per horse power was sufficient; some allowed more, and some less; but generally speaking, three quarters of a square foot was allowed. In the application of fuel there was also considerable difference. It might be applied so as to produce considerable effect, or so as produce comparatively little effect. In this consisted what was called the art of stoking; and in no place was this worse done, in no place did it need to be better done, than on board ships. The coals should be spread lightly upon the grate; and when in a state of incandescence, the stoker should push it back, and lay on more coals. The first effect would be, that the coals first laid on would be coked. The heat would be so great that the gaseous part would be expelled. These gases would be impelled forward by the draught; and as they passed the incandescent coal, they would be consumed, and no smoke would issue from the chimney, the smoke being the unconsumed part of the fuel. As soon as the coke at the back was consumed, the stoker should push back that in the front, and introduce a further quantity of fuel. This would make a common furnace, in fact a smoke-consuming furnace, and there would be a uniform evaporation of steam. But was this the practice observed? By no means. Neither in marine boilers nor in land boilers had the stoker any idea of taking any such pains; he adopted not the most efficient way, but the way most comfortable to himself. He proceeded in this way: he let the fire in the grate be nearly out, he then put in an enormous quantity of coal; the consequence was, the very instant this was laid on, there issued an enormous quantity of smoke, which might be frequently seen issuing from the chimney of a steam-boat. That went on for some time, till at length the chimney got a little rest. This was nothing more than the effect of putting on fresh fuel; and the smoke continued till it was burned red, and it suited the stoker's pleasure and convenience to open the grate again. In some of the best conducted government vessels this was not allowed. They paid their stokers sufficient wages, and made them do their work; and on the *Medea*, for instance, there was no smoke from the chimney at all. There was nothing new in this. Mr. Watt proposed it; and in his factory at Soho, smoke was never seen issuing from the chimney. The only effectual remedy which could be devised would be to feed the furnace by self-acting grates. One had been invented in which the grate was made circular, and it revolved. The feed of coal was placed in a hopper, and the coal passed through it like a funnel. The coal was put in that part of the grate furthest from the flue. This machine was kept in motion by the engine itself, so that to a furnace of this kind there was little necessity for the attendance of men at all.—*Midland Counties Herald.*

THE FRENCH HISTORICAL COMMISSION.

(Extracted from the Gentleman's Magazine for February, 1840.)

The Report on the labours of the Committee of Arts and Monuments is so extremely interesting, that, were it not too long, we should be inclined to translate the whole. The object of this Committee is not only to publish a complete survey of the monumental antiquities of France, but also to provide for the preservation of the monuments themselves. A series of printed questions is sent to every parish throughout the kingdom, in order to obtain the primary information to regulate the proceedings of the Committee in this survey. The undertaking will require many years, and much money. Those districts and monuments will be taken first in order which are of the greatest interest, or are most important in their character, or which are in the greatest danger of perishing; for the Committee has established it as a rule, that an edifice which is threatened with ruin shall always be preferred to a monument which is in a good state of preservation. At present this Committee is occupied in the publication of specimens or models of the different forms which its labours will take. These are to be, 1, the complete survey in description and delineation of the cathedral of Noyon, as a specimen of severe ecclesiastical architecture, and, 2, of that of Chartres, as being the most extensive and superb ecclesiastical edifice in France; 3, the Roman, Merovingian, and Carlovingian antiquities of Paris, as a specimen of the mode in which the great towns will be treated; 4, the description of the arrondissement of Rheims, as a model of the monumental statistics of the provinces.

"The mission of the Committee is, in fact, to search *notre France monumentale;* to catalogue, describe, and delineate all the objects of art scattered over our soil; to draw up an archæological register, so succinct that the monuments of every age and of every kind may be mentioned in it, and of such an extent that every work of art may obtain in it a place proportionate to its esthetic or historical value.

"Two orders of works are therefore to be prosecuted under the direction of the Committee: statistics for all the monuments without exception; monographies for those monuments of importance which could not be developed sufficiently in the statistics. The Committee cannot itself execute all the statistics, which will amount to eighty-six if we proceed by department, and to three hundred and fifty if we proceed by arrondissement, and give separately the statistics of several large cities, which seems desirable and necessary to produce a complete work. Neither can the Committee undertake directly all the monographies, which will amount perhaps to three hundred, which is nearly the number of the important monuments in our country which appear to merit a special work. Time and money would be wanting for such a colossal work. On the other hand, it would not do to let the designs of the Committee be regulated by chance, or to abandon them to the individual caprices of all those who might think proper to undertake an historical work on the monuments. It has therefore been thought indispensable to fix an uniform plan, and to apply it invariably to everything that shall be undertaken, without as well as with the Committee.

"Two means of attaining this result offered themselves; both have been adopted. In the first place monographies and statistics will be given as models, to which all future monographies and statistics will conform, as well in the scientific plan as in the material execution. Next, instruction will be sent to all the correspondents, and to all the antiquaries in France, to indicate the plan according to which their researches must be made, to fix the expressions which are to be used in the description of a monument, and the characteristic signs which serve to class the works of art, and to determine their age.

"As to the statistics, they will be of two kinds; those which include all the monuments of an arrondissement, and those which only comprehend the monuments of a great town.

"For the model of the statistic of an arrondissement, that of Rheims has been chosen—one of those which are most numerous in communes, and one of the richest in monuments. An architect of Rheims, M. Hippolyte Durand, has been employed to make all the drawings; the archivist and librarian of the same town, M. Louis Pâris, will write the history of the edifices; the secretary of the Committee, M. Didron, will give the description of all the monuments which will be represented by engraving and lithography.

"Paris has been chosen as the model of the statistic of a great town. This work has been entrusted to M. Albert Lenoir, who will give drawings and descriptions of all the Roman, Merovingian, and Carlovingian monuments which formerly adorned the town of Paris, and which have left numerous and imposing ruins. Paris, which possesses monuments of all epochs, from Julius Cæsar to our own days, will serve as a type for those great towns in France, Lyons, Rouen, Bordeaux, and Strasbourg.

"The Committee will give also two models of monography; for, the monuments of France being splendid or austere, it is necessary to take a severe monument and a sumptuous one.

"The cathedral of Noyon, graver still since the revolution and the course of ages have broken the statues of its portal and its painted windows, has been selected as the type of a church at once severe and original. By an exception which is rare in France, this cathedral is rounded at the extremity of its transepts, as at its apsis, and it is fronted by a porch on the west. M. Ramée has just finished the drawings of this curious monument, and M. L. Vitet, member of the Chamber of Deputies, is preparing the text.

"The Cathedral of Chartres appeared to be the monument the most complete and the richest in France—we may almost say, in Europe. Nôtre Dame de Chartres is a cathedral far more considerable than the others, by its crypt, which extends the whole length of the building; by the numerous sculptures which decorate its royal portal and its lateral porches; by its two western spires, perfect models of the architecture of the twelfth and of the fifteenth centuries; by the six *amorces* of towers which rise at the *croisillons* and at the apside; by the delicate sculptures which adorn the enclosure of the choir; by the painted glass which fills all the windows; by a great chapel—we may almost say, a little church—which the fourteenth century has attached to the great edifice of the thirteenth.

"The drawings and text of this monography appeared to be of too high a degree of importance to be entrusted to a single person. Two artists have been joined together for the graphic work: MM. Lassus, architect, and Amaury-Duval, painter. M. Lassus will make all the drawings of architecture and decoration, and will make the plans, and give the sections and elevations; M. Amaury-Duval will draw all the sculpture. The text itself, which will accompany and explain these numerous designs, will also be divided. In a literary work on a monument like Nôtre Dame de Chartres, there are two parts which are very distinct: the history of this monument, which relates its foundation, its vicissitudes, the life of the personages who have inhabited it, so to speak, that of the bishops who have adorned, enlarged, and modified it, in fact the history of its former times; and the description which tells its present state, which describes by language all its stones one after another, all the statues, all the figures painted in fresco or on glass, all the various forms which sculpture has impressed on different materials to give them a character, a style, which indicates an epoch, an age. The history of a monument, in fact, is still more different from its description, than architectural drawings are from drawings of figures; and, since there were two artists for the graphic part, it was but logical to make the same division of the literary part of the undertaking."

Besides doing all that may be possible to preserve the ancient monuments from ruin, the Committee of Arts and Monuments has taken measures to form a Museum of National Antiquities, in which the fragments of such monuments, as their endeavours have not been able to save from destruction, may be deposited.

"In spite of the zeal of the correspondents, in spite of the ardour of the Committee itself in defence of monuments threatened by men or ruined by time, many objects of art perish, many edifices fall; and, since there exists no place destined to receive the fragments, we lose even the last trace of the most interesting monuments. Since the destruction of the museum of the Petits-Augustins, our national archæology has sustained losses of this kind which are irreparable. Latterly, when the restorations were made at the church of St. Denis, when the mutilations were perpetrated on the church of St. Benoît, when the churches of St. Côme and of Cluny were demolished, they were forced to throw away among the rubbish bases and capitals of columns, sculptured tumulary stones, carved frieses and gargoyles, because the royal museums which are consecrated to pagan antiquities, cannot and will not receive national antiquities. Such a state of things could not last long without the greatest detriment to history; for no archæological studies are possible without monuments, and the monuments become rarer every day.

"Struck with these injuries inflicted upon art and historical studies, the Committee, on the proposition of Baron Taylor, begged the Minister of the Interior to grant a place for the temporary reception of the objects of art scattered in a thousand places, and which may be collected together. Afterwards, the necessity will be felt of forming a gallery of the fragments which will be gathered by little and little at a small expense, and we shall thus have a museum of Christian antiquities, which may be compared with pride to the museums of pagan antiquities. In this museum, besides the pieces which are originals, may be placed, as has been done at Louvre for the Greek and Roman monuments, plaster-casts of the finest works of art, statues, and bas reliefs which decorate our edifices of the Middle Ages. Several provincial towns already possess a Christian museum; Paris must not be behind Dijon, Orleans, Puy, Mans, or Carcassonne. The Minister of the Interior received in the most favourable manner the proposition of the Committee, and has made a formal promise to dedicate the church of St. Martin-des-Champs, now dependant on the Conservatory of Arts and Manufactures, to the reception of the fragments of Christian architecture and sculpture which may be collected at Paris and in the departments. This church, which, with St. Germain-des-Prés, is the oldest in Paris, is also the most curious for the originality of its construction and decoration; it is admirably fit for its new destination—the casket will be worthy of the precious objects which it will contain. The Minister of the Interior has promised to cause to be restored, for the object above specified, this church, which threatened to fall into ruins from the effects of age, or which was going to be demolished to make room for a *mairie*. The Committee regards this result as one of the most important it has yet obtained, and knows not how to thank sufficiently the Minister of the Interior.

"When a monument falls of itself, as has lately happened to the church of St. Sauveur at Nevers, the Committee will have but one resource, and that one it will use immediately; this will be to send an architectural draughtsman to the scene of the disaster, and to give him the task of collecting, or causing to be preserved in a museum, all the valuable fragments which may not be broken to pieces; of drawing, on the faith of traditions, on the inspection of old engravings, and the examination of the locality, a plan, sections, elevations, details; of stating, in a circumstantial report, the cause of the accident, in order to prevent the fall of monuments which may be threatened with ruin under the same circumstances. The draughtsman will return to Paris with the fragments, which will be placed in the museum,—with the drawings, which will be engraved,—with the report, which will be published. Of the ruined monument will be presented at least its portrait and some fragments. This is precisely the mission which, in the case of St. Sauveur, the Committee has entrusted to M. Robelin, architect, non-resident member of the Committee, and charged with important works in the Cathedral of Nevers, his native place."

All the evils here mentioned and provided against, are felt equally, if not more, in England; our national antiquities are daily perishing; we have no museum to receive the fragments, no public spirit in our government to provide for them, and only here and there a solitary individual who, at his own risk and inconvenience, will use his exertions to preserve, will afford a shelter to what can be saved, or will publish, or cause to be published, drawings and descriptions. We rejoice at the exertions of our neighbours, though we have reason to be ashamed at being left so far behind them. Yet we think we see at home a new spirit rising and spreading itself, and we hope that it may bear its fruit before it be too late.

We ought to add, that the Committee of Arts and Monuments is publishing manuals of the different branches of archæology, drawn up by the first scholars in each branch, and intended more particularly for the use of its correspondents, to draw their attention to the different points most necessary to be observed, to fix a standard to guide them with certainty in their researches and observations, and to give with accuracy and certainty that elementary knowledge which is necessary to enable them to work efficiently.

MESSRS. FAWCETT AND CO.'S ENGINE FACTORY, LIVERPOOL.

(From the Liverpool Standard.)

THE object of the establishment is principally the construction of marine and other steam engines, mill machinery, pieces of ordnance, and other heavy articles of the foundry and the forge, which here pass from their rudest state, through the various requisite processes, until they are turned out bright and perfect from the hands of the finishers. The magnitude of the works may be estimated from the facts, that the premises stand upon an area of many hundred yards; that that space, nearly covered by lofty buildings, is found incommodiously small; and that the number of workmen employed in the various departments considerably exceeds seven hundred. The writer of this was a few days ago politely permitted to view the works, and was furnished with such information as the shortness of his visit would allow, by one of the partners, as well as by an attendant. We shall now notice the several departments under their respective heads, and shall conclude with some particulars of the fine marine engines now in a state of forwardness.

Founding and Boring of Cannon.

On entering the yard the attention of the visitor is arrested by the great number of cannons of various sizes and calibres, from swivels and half-pounders to thirty-two pounders, ranged on the ground, or peeping, in carriages, with portentous aspect, from door-ways, entrances, and corners. The large guns are of various fashions, some being cast from the plain models used in the French navy, others from those of the Dutch, and others (the handsomest to our thinking) of the more decorative form approved in England. In casting these guns (all solid), what is called "a head" is cast along with them, at the muzzle end, having the appearance of a plug or long tompion. This is cut off before the boring is commenced. At the breech, too, an additional square piece of the metal is cast on, by which the gun is turned by machinery while it is being bored, the borer being stationary in the operation. When outwardly cleaned and finished (with the exception of drilling the touch-hole and fixing the lock), the gun is placed horizontally, and secured so as to turn without vibratory motion. The machinery is then applied, and the gun turns rather slowly, advancing with an even pressure upon the large steel boring instrument, and continually discharging the metal which it cuts out. The gun has to be bored two or three times, according to its calibre, and when the operation is completed the bore is as bright and true as that of a fowling piece. The touch-hole is afterwards drilled out with great nicety, as are the holes, in raised portions of the breech, for the fixing of the flint lock, which has now in gunnery almost superceded the use of the match. Several guns are bored daily and simultaneously, to meet the demand at home and abroad, and a large "assortment" is kept constantly on hand to supply those governments and individuals who are bent on "mischief" or self-defence. Amongst the pieces of ordnance now in preparation or finished at the works are:—

26 thirty-two pounders, for a French house.
20 twenty-four pounders, another French order.
4 twelve pounders, for the same.

The Foundry.—This part of the works differs from most other foundries only in the immense weight of the castings, which, from the size of the building, and the number of blast furnaces, cranes, &c., may be turned out. Single pieces of twenty tons each might be accomplished, if required. The operation is interesting, but it is too generally known to require detail. The article to be cast is moulded (in sand) from wood, and enclosed within iron frame-work, a hole being left for the entrance of the metal. The metal (cast-iron) is thrown, in broken pieces, mixed with coals, into a large cylindrical furnace, the blast thrown into which, by machinery, with great force, makes a roaring noise, and soon brings the whole to a white heat. The metal, as it melts, sinks to the bottom. When all this is ready, a perforation is made with the point of an iron rod, through a sort of doorway at the bottom, which at that point is stopped up by fire clay. The boiling metal immediately rushes out in liquid white fire, and is received in pots with three long horizontal iron handles, two at one side, like those of a hand-barrow, and one at the other. By these it is carried by three or four men, according to its weight; and if the casting or castings be comparatively small, the metal is poured at once from this into the moulds, the pot being turned by the men holding the two handles. If, however, the casting be large, the smaller pots full of liquid metal are discharged into a cauldron of sufficient size, and this, from its great weight, is hoisted by a crane and placed over the casting, where it is discharged, in a careful manner, of its contents. The air, forced out of the sand by the metal, frequently makes a loud explosion, (as we witnessed,) and when the intense heat of the hissing iron perforates the outer portions of the same, blue and sulphureous looking flame issues from the sides in all directions. When the metal is sufficiently cooled, the frame-work is removed, and the castings taken out. Here may be cast any article, from a lath nail to a steam-engine cylinder, weighing from ten to fifteen tons.

The Working Engine on the Works.—On the east of the yard, on each side of which are the extensive buildings, is the larger engine, of thirty-six horse power, which works the greater part of the machinery used in the different rooms, in the several operations of turning, planing, drilling and otherwise "torturing" the obdurate but conquerable metal that falls under the cruel hands of the workmen. This engine is of the old-fashioned principle, with an immense wooden beam, secured with iron, and a large fly-wheel. It is, however, most effective, communicated by cog-wheels and shafts with the several rooms in which the power is applied to the lathes, &c. by drums and shafts. There are also other engines, but of considerably less power.

The Smithy.—This is one of the most extensive portions of the establishment. It comprises two large buildings thrown into one; and a great number of workmen are constantly employed. There is an avenue of anvils, and the constant hammering, the blowing of their fires, together with the dusky visages of the athletic workmen, remind one of the description of the abode of the Cyclops. Here, however, "bolts" are "forged," of which neither "Jove" nor his armourer "Vulcan" could have conceived any notion. All the iron-work for the steam engines is here made, with the exception of the very heavy paddle-shafts, which are brought in the rough from the Mersey Forge.

The Planing-machine Room.—In this room are valuable and elaborately-contrived machines for the planing or levelling of large plates, or other pieces of iron or brass, so as to give them a smooth, true, and polished surface. The article or piece to be planed is securely fixed by screw-bolts, &c., to an horizontal iron table, perforated with holes for the insertion of the bolts from beneath it in any required point, to suit the size or form of the article. This table, when put in motion, travels backwards and forwards, with its load on two iron rails, or parallel slides. Over the centre is perpendicularly fixed what is called the "planing tool," an instrument made of steel, somewhat in the form of a hook, with the point so inclined as to present itself towards the surface of the metal to be planed, as it approaches it on the table, so as, when all is adjusted, to plough or plane it in narrow streaks or shavings as it passes under it. The extremity of the tool is about half an inch to three quarters in breadth, and being of a round form at the under side, and ground or bevelled on the upper, presents a sort of point. If a plate of iron is to be planed, the operation commences on the outer edge, and each movement backwards and forwards of the table places it in such a position under the tool, that another small parallel cut is made throughout its whole length. The tool, in ordinary machines of this kind, is fixed so that it cuts only in one direction, as the plate is drawn against its edge or point, which is raised to allow of the backward motion of the plate. A new patent has, however, been obtained for a great improvement in this respect by Mr. Whitworth, of Manchester, and several of his machines are on Messrs. Fawcett and Co.'s premises. In these, by a peculiarly beautiful contrivance, the cutting instrument, the moment the plate passes under it, "jumps" up a little in the box or case to which it is attached, and instantly "turns about" in the opposite direction, and commences cutting awey, so that both backwards and forwards the operation goes on without loss of time. The workmen very quaintly and appropriately call this new planing tool "Jim Crow." A workman attends to each of the machines, and when the piece to be cut is fixed with great exactness on the moving table, by a spirit level, he has nothing to do but to watch that it remain so, and that the machinery work evenly and correctly. Where a very smooth surface is required, the operation of planing is repeated, and two plates thus finished will be so truly level, that they will adhere together. It should be added, that so perfect are these machines, that in addition to planing horizontally, they may be so adjusted as to plane perpendicularly, or at any given angle.

The Turning Rooms.—In several of the rooms both hammered and cast iron of all possible dimensions are turned, with astonishing facility and correctness, on what are called slide lathes. In one of these we saw the paddle-shafts for the President under the operation. Each of these weighed, when they came from the forge, about ten tons, and they will be but slightly reduced in weight by turning. In the same room large piston and other rods were being turned. While the shaft or rod is revolved, the cutting instrument, fixed to a slide, on which it is slowly and evenly carried along, performs its operations with wonderful precision, frequently cutting a large and continuous shaving of thirty or forty feet in length (as may be,) apparently as if it were lead, and which, curling up, forms a curious and perfect worm or screw. From the great pressure of the tool, one of the edges of this screw is frequently split into regular teeth like those of a fine comb, but shorter. The tool, when it has gone from end to end of a shaft or rod, is, by a simple adjustment, made to travel back again, and the operation is continued till the whole is of the required diameter, and perfectly bright and polished. Another interesting operation in this department is the turning and polishing of circular pieces of machinery, whether dished or flat. The tops or lids of the cylinders of large engines are the principal, and some idea may be formed of the advancement of this art, by an inspection of the cylinder tops of the President, which are as bright as mirrors, and are 80 inches in diameter! Water constantly dropping on the cutting tool from a small pipe, is all the "oil" used either in planing or turning.

The Fitting-up Shops.—There are several rooms in which the "fitters-up" are employed. These finish the smaller brass and iron-work of the engines, and have turning-lathes, and all manner of hand-tools. In the building of an engine, they hold the same relation to the foundry and the forge, that the clock and watch maker (properly "finisher") does to the establishment that supplies him with his wheels and other works in the rough.

The Model or Pattern-Makers' Room.—These rooms are extensive, and many first-rate workmen are employed, the greatest exactness being required, otherwise the castings would be unavailable. The timber used is almost wholly well-seasoned deal. Many of the patterns are complicated and beautiful, a great deal of taste being displayed in the mouldings and other decorations, where such can be appropriately introduced. The models are all finished and polished in the best possible manner.

The Model Rooms.—These are a lofty part of one of the buildings, and are well worthy of a visit. In one of them we were fairly lost, amidst many hundreds of bevelled, cog, and other mill wheels, of all possible sizes, (few alike) and piled up to the very roof. Many of these are, we learned, for the purpose of supplying foreign orders. Here, too, are a variety of engine-bed plates, paddle-wheel centres, patterns for water and other wheels, &c. &c. all made with mathematical accuracy.

In another room were an immense number of models of great guns, as adopted, in outward fashion, by the English, the French, the Dutch, and others. The models of beams for marine engines, of all sizes, were here piled; also of Ionic fluted pillars for their frames. The models from which the beams, &c., of the Royal William, and many others, were cast, are here deposited, as are those of the larger engines in the yard below. The collection of patterns of all descriptions is indeed great and excellent, and must have cost an immense sum of money.

The Engines now in course of completion.—The following engines are now in hand at the works, and the three largest nearly completed:

1 pair of 540 horse power for the "President."
1 do. 420 ditto the "United States."
1 do. 450 ditto a French man-of-war steam frigate.
1 do. 300 ditto H. M. S. "Medina."
1 do. 50 ditto the "Calcutta Steam-tug."*
1 do. 45 ditto a Government tender.†
1 single engine of 60-horse power, for Australia.
1 do. 50 ditto for a French house.

The President's Engines.—These are the most remarkable for their size, and are really a stupendous piece of workmanship. They are already fixed up, and strike the visitor with astonishment. The castings, and all the workmanship are of the first description, and the architectural design of the framework, or pillars, is highly ornamental, without any sacrifice to the requisite strength. As probably the most suitable to attain this desideratum, the Gothic style has been adopted. The massy clustered pillars are surmounted by the pointed and moulded arch to correspond. The diagonal stays and their open work are in keeping; and such is the height and imposing effect of the whole, that visitors generally remarked that it strikingly resembled a handsome Gothic chapel. The beams are beautiful castings, as are the cylinders, and both of immense size and weight. The polished iron and brass work is superb, and the whole furnishes a gratifying proof of at once the enterprise and the ingenuity of the men of England. The following are some interesting statistics of this stupendous piece of machinery:

Diameter of cylinder..............	80 inches.
Stroke of engine	7 feet 6 inches.
Weight of cylinders	11 tons.
Valve-cases, from	6 to 6½ tons.
Beams (4 in number), upwards of ..	5 tons each.
Condensers, about	10 tons.
Gothic pillars, four pairs, each	11 tons, 7 cwt.
Diagonal stays, 4 in number, each....	4 tons.
Main, or paddle shaft..............	9 tons.
Two eduction pipes, each	18 cwt.
Boilers, each	30 tons.
Bed-plates, (two,) each in one casting	15 tons.

The whole engines and boilers, with the water, will weigh about 510 tons.

The hoisting-tackle used in setting up these engines is well worthy of notice. On the principals, or lower beams of the roof, which are of extraordinary strength, railways are fixed, upon which traversed scaffolds, railed round, and each carrying a powerful winch. On these scaffolds are also railways, at right angles with those on the beams, so that, by moving the scaffolds and the winches, any spot in the building may be attained directly perpendicular to the article to be hoisted, which, by other movements, can be lowered to any given site.

The Engines of the "United States."—These are precisely similar in construction to those of the President, differing only in being a little smaller. No detailed notice of them is therefore required. The cylinders are 73½ inches in diameter, and the power is the same as that of the Great Western,—namely, 420. They are erected in the same shed, or building, containing those of the President, and have been equally admired.

The "Medina's" Engines.—These are of 300-horse power, and though different in the style of the casting, are also got up in the best manner.

The whole three pairs of engines will be ready simultaneously for shipment; but, unluckily, the want of want of proper shears to hoist in the machinery and boilers, (there being but one pair at the Canning Dock, and a crane at the Trafalgar,) one or other of the vessels will have to wait her turn.

The pair of 45-horse power engines, for the Admiralty, are also in a forward state; as are most of the others before enumerated.

Such is a sketch of the works at Messrs. Fawcett and Co.'s establishment. We do not remember to have enjoyed a greater treat than in visiting it, and it was with considerable reluctance, that having other engagements, we could not prolong our stay on the premises, and examine some other departments. The whole is a world of mechanism within itself; and though it send forth huge and deadly weapons of war, it also produces maritime machinery calculated to extend civilisation, and to promote the amicable commercial intercourse, and mutual wealth and happiness, of nations scarcely known to each other but by name.

This firm have upwards of 700 workmen. The President will be the largest steam-packet in the world. Messrs. Fawcett and Co. have been applied to by the Bristol Steam Packet Company to make them engines of 600 horses' power each, but their present engagements do not permit of their accepting the order.

DESIGNS FOR LAYING OUT THE ROYAL BOTANIC GARDENS, INNER CIRCLE, REGENT'S PARK.

The Council of the Royal Botanic Society being desirous of giving every opportunity of securing the most efficient assistance in laying out their Gardens in the Inner Circle of the Regent's Park, announced some time ago their intention of giving a premium of fifty guineas for the best design submitted to them. During the last month the designs were exhibited for inspection in the rooms of the Society, in Pall Mall, where they have been visited by many persons connected with the Society, and by artists. It is probable that the rooms will remain open for a few days longer, previous to the decision of the Committee, until which time any of our readers would doubtless be able to obtain access to them.

The instructions drawn up for the guidance of candidates in some degree, limited them both as to the nature of the plans, and the kind of drawings they were recommended to send in. The instructions directed that a large portion of the ground should be devoted to a geographic arrangement of the plants in twelve separate compartments; the gardens should be provided for the special study of plants, as regards medicine, agriculture, arts and manufactures, scientific arrangements, and experiments; that proper conservatories and buildings should be provided. The plans were restricted to a scale of fifty feet to an inch, and it was stated that sections and detailed plans were not required. The number of designs sent in is above twenty, from many men of eminence and respectability, principally architects, but the exhibition as a whole does not show that talent which might be expected.

1, is merely a plan of the grounds in their present state.

2, by H. P., Spring Terrace, Wandsworth, is distinguished by two principal features, a nascent yearning for some hot water apparatus which is in futuro, and a parade of Owen Jones's Alhambra, the Alpha and Omega of the inventor's artistical knowledge, from this he has sucked the inspiration of a court in the Moorish style, and of a flight of steps decorated with *azulejos*. These our readers know are painted tiles, and unless he could resuscitate the Andalusian artists, we fear that they would be little better than the antiquated Dutch tiles, long since consigned to the chimney corner. The design, if it may be so called, is to form an endless walk in the gardens, so that you would never pass over the same path again.

3, by John Aiton, of Mr. Pearson's Nursery, Hampstead-road, is merely a gardener's arrangement of the plants.

4 and 5, by Martin Joseph Stutely, Architect, Gower-street, Bedford-square—5, is the ground plan, and 4 an isometrical perspective view. This design is an adaptation to the present state of the grounds, and consequently meagre. The buildings, mostly Italian, are poor. One excellent feature is a large conservatory on the north side, standing on a raised terrace, which commands a view over the Lake in the Park, and up the Vale towards Hampstead, bringing that fine scenery as it were into the Society's domain. A large raised seat affords a view of Primrose Hill.

6, John Bainbridge, flower gardener to Lord Wenlock, Escrick Park, near York—a botanical arrangement; the walks in a fantastic style; and an imitation of the various mountains on the face of the globe.

7, Alfred Bartholomew, architect, Warwick House, Gray's Inn. There is a want of effect in this design, but the arrangement suggested for the plants is ingenious. The ground is divided by imaginary lines into gores, each appropriated to the plants of some geographical region, and these gores again subdivided by concentric circles so as farther to distribute in each region the plants into the several classes of arts and manufactures, agriculture and science. In the centre is an angular conservatory. The explanations attached to the designs affords many useful remarks. Mr. Bartholomew suggests that the capitals of the columns of the conservatories might be taken from botanical subjects, and made in clay or artificial stone. A canal supplies water all round the garden.

8, W. Billinton, architect and civil engineer, Wakefield. This design is mainly a geographical arrangement, without much attempt at pictoral effect; it seems doubtful also whether the grouping of the buildings would be good. The book of explanation shows an intimate acquaintance with practical horticulture, and contains many good suggestions, particularly with regard to maintaining an equable temperature in the large conservatory by double domes.

9, John Burges Watson, architect, 39, Manchester-street, Manchester-square. This design is illustrated in the margin by sketches of the buildings, many of which are pleasing, the plan however is not effective except with respect to a lake, apparently imitated from a former design of Mr. Henry Laxton;* from whom he seems to have derived other ideas. The reasons

---

* Now building in India.

† To run, it is said, between Dover and Calais.

* See a plan of the Royal Botanic Gardens, in the Journal, vol. 1, p. 359.

Mr. Watson gives for the position of the conservatories is good, and the efforts of a cultivated artist are visible in many parts, both of the plan and explanation, which show the results of his experience at Chiswick, where he was employed; he has not however been so successful as on former occasions, when he carried off the fifty guinea prize for laying out the gardens at Manchester.

10, **Henry Laxton**, F.L.S., and **John Thompson**, landscape gardener, late head gardener to the Duke of Northumberland. This plan is principally Mr. Laxton's, but we shall dismiss it in a few words, to come to some of his other designs. It is chiefly laid out as a large flower garden, and the compartments exhibit great ingenuity. The book of reference shows great acquaintance with the botanical part of the subject. The conservatory in the centre is circular, with arms in the form of a Greek cross.

11, **Henry Heathcote Russell**, architect and civil engineer, Springfield Lodge, Garrat, near Wandsworth. A design adapted with much ingenuity to the present state of the grounds—it has, however, the usual imperfection, want of effect. A conservatory is made to run all round the gardens, which however is impracticable, on account of the state of the grounds.

12, **Edwin E. Merral**, 35, Park Lane, Leeds. This seems to be by the eminent Hollander, 'who wrote a book of boetry as dick as dat,' the crowning idea is a central platform 200 feet diameter, 5 feet high, and surmounted with an iron railing.

13, **Henry Laxton**, F.L.S., architect and landscape gardener, Adelphi Chambers. Mr. Laxton who had a great hand in laying out the grounds at the Beulah Spa, is the surveyor of the gardens to the Royal Botanic, part of whose grounds he has laid out. He has sent in four designs, all exhibiting great attention to the subject. No. 13 has a lake on the north side, before which is an extensive lawn, most essential to a metropolitan garden, where a large concourse of people is likely to be occasionally collected. In the centre of the gardens is a spacious domed conservatory, and on the south side is the principal building for the official department with a large Italian garden, surrounded by raised terraces with extensive conservatories on each side. The whole of the gardens is surrounded by an arboretum.

14 and 15, **Charles J. Nicolay**, architect, Elm Grove Cottage, near Winborne, Dorset. The ground plan is accompanied by sections showing buildings in the classic, oriental, and Tudor styles. The conservatories are on a raised platform in the centre, and the scenery on the south front is made attractive:

16, **Wyatt Papworth**, architect, 10, Caroline-street, Bedford-square. There is considerable variety of effect and breadth in this design. The ground is formed into three divisions. The first devoted to the business part of the establishment is formed by buildings with south aspects, screened at the base by trees. The second which has rock work at one end and the museum, &c. at the other, is an ornamental garden, and has to the south, the grand front, a conservatory, flanked by trees and rock work. The third division as seen from the back of the grand conservatory is a spacious lawn with a back ground of trees and shrubs.

17, **Edward Lapidge**, Derby-street, Parliament-street. This would be a grand design for St. Petersburgh, but would not be so pleasing here as it is an entire sacrifice of the beauties of nature to architectural effect. On a raised platform in the centre is a hollow square of buildings covering the area of the Great Pyramid or of Lincoln's Inn Fields.

18, is a plan of Mr. Laxton's making the arrangement of the gardens at present, immediately available on an economical scale, the leading feature is a promenade walk, through the centre 30 feet wide; the outer boundary has a winding walk of about three quarters of a mile in length, judiciously laid out for an arboretum.

19, also by Mr. **Laxton**, is a design much resembling No. 13, but grander in its architectural and horticultural arrangements, so as to produce one mass of variegated effect in the shape of Italian, Dutch and French gardens, rosaries, fountains, statues, casinos, conservatories, terraces, &c.,—if sufficient funds could be raised for carrying out the whole of the design at once, without regard to the present form of the ground, we should prefer this design to any other.

20, G. A. **Cheffins**, architect, Lees-street, Piccadilly, Manchester, is the only one of the architectural competitors who is very much behind hand. His design is very nearly akin to that of the Dutch gentleman who composed No. 12. It must have puzzled Mr. Cheffins to produce any thing so bad.

21, R. H. **Essex**, 13, York-buildings, New-road. This is the climax of all that is rich in the ludicrous. A map of the world is laid down as the ground work, and a most farcical distribution of the necessary buildings is made. A gardener's cottage in the centre is at the sign of the North Pole, the lecture rooms are in the Atlantic ocean, (a witty gentleman, thought the Pacific better), the Great Desert of Africa serves as a nursery, the meridian of London is denoted by a sundial, and the capital cities of Europe by sundials. Really, really, Mr. Essex, you must have intended to enliven this otherwise dull exhibition.

LITERARY NOTICES.

A system of Practical Arithmetic by **Samuel Young**, is intended for the use of the working classes, from whose pursuits the examples are derived. This is certainly a more laudable effort than some of the nauseous affairs which are used in religious schools. The work seems carefully arranged.

On the Construction of the Ark, as adapted to Steam Navigation to India, is an effusion of a Mr. Radford. If our readers have any money to spare for metaphysical experiments, we recommend them to buy this work as a good example of how far hallucination can proceed.

On the supply of Water to the Metropolis.—This pamphlet gives a brief account of the extensive works that have been carried on by the Water Companies for the last five or six years, for improving the supply of the Metropolis with pure water. The author very evidently is a stickler for the existing companies, and ably advocates their cause; but he has allowed his zeal to overstep the mark of prudence. We shall, next month, make some additional remarks.

WORKING EXPENSES OF RAILWAYS.

Abstract of the different items of the working expenses on several lines of Railway now open: showing the ratio per cent. each item bears to the gross Receipts, and the amount of each per mile, for the half-year ending December 31, 1839.

	Name of Line.	Gross Expences.		Maintenance of Way.		Locomotive Power.		Carrying, Police, and Taxes.		Other Charges.	
		Per cent. on gross receipts.	Per mile.	Per cent. on gross receipts.	Per mile.	Per cent. on gross receipts.	Per mile.	Per cent. on gross receipts.	Per mile.	Per cent. on gross receipts.	Per mile.
			£		£		£		£		£
Opened the whole length	London and Birmingham ..	37·4	1143·6	13·1	461·	9·	277·7	13·	264·5	2·	62·8
	Grand Junction	47·4	958·9	4·5	125·	16·9	343·3	22·	443·6	4·	81·2
	Liverpool and Manchester ..	53·2	2503·9	4·1	194·3	19·1	898·6	23·4	1106·	5·9	277·9
	Leeds and Selby	49·3	681·4	9·2	127·7	18·7	258·8	18·4	256·6	2·7	36·0
	Greenwich	65·5	4828·	8·8	648·6	20·4	1504·1	27·7	2041·9	8·6	633 3
	Sheffield and Rotherham ..	46·7	565·3		*						
	Glasgow and Garnkirk	56·7			*						
Partially opened.	Great Western............	48·8	1037·7	7·2	154·2	18·8	401·	16·4	349·5	6·2	132·9
	South Western	54·1	716·4	11·6	153·9	21·9	290·1	20·5	272·3		
	York and North Midland ..	28·1	208·3	†		12·4	91·8	11·2	83·6	4·4	32·9
	Eastern Counties..........	51·3	395·	†		24·	185·3	21·2	163·8	5·9	45·5
	Birmingham and Derby	74·2	322·7	16·4	88·4	25·4	110·6	32·2	145·9		
	Average	51·2		9·3		18·6		20·6		3·9	

* These items not mentioned in the published accounts.

† In hands of contractors.

Notes.—The London and Birmingham was chargeable with maintenance of way on 78 miles for six months, and on 34½ more for 15 weeks=97¾ for 6 months. The other items are upon 112½ miles.

The Grand Junction is chargeable with maintenance of way on 82½ miles—and the mileage of that item is calculated on that distance—but as they carry their traffic to Liverpool and Manchester, on the Liverpool and Manchestar line, the other items are calculated on 82½+30=112½ milles.

The Birmingham and Derby maintain 38½ miles of line; but as they carry for 9 miles on the London and Birmingham line, the other items must be charged upon 47½ miles. This line was only opened in August, but the charges are calculated at the same rate for six months.—*Correspondent of the Railway Times.*

Iron Canal Boats in America.—The success of this class of boats in England, with the arrival of the Iron Steamboat at New Orleans from Pittsburg, (of a very light draught of water, carrying a great cargo,) has led to the opinion that iron canal boats, if used on the Erie canal, would double its capacity, and supersede the necessity of the enlargement. We trust that some of our enterprising forwarders will try the experiment. We are not fully acquainted with the cost of these kind of boats, but have been informed, that it will not exceed fifty per cent. on the cost of the best Lake boats. In Pennsylvania, with their mixed line of canals and railroads from Philadelphia to Pittsburg, they now use iron boats, divided into three parts. The iron boat is carried into Market-street, Philadelphia, on the return of the cars, at the Schuylkill canal they are hooked together, forming a complete boat, which afterwards passes the Allegany-ridge, by ten inclined planes, when they again take the canal and river, to reach Pittsburg. With this complicated system, they compete with us successfully for the early spring trade.—*American Railroad Journal.*

Destruction of Wooden Bridges in America by Ice.—The breaking up of the winter has caused a recurrence of a specie of accident which is far from being rare. We allude to the destruction of bridges by the combined force of a swollen stream and immense masses of ice. The liability to this kind of accident depends more upon the character of the stream nearer its source than at the location of the bridge itself. A river of any considerable size receiving the drainage of a large track of country, is of course apt to be speedily swollen by a sudden and heavy fall of rain or rapid thaw, and as one or the other of these circumstances are sure to accompany the breaking up of the ice, such streams must present locations badly adapted to ordinary wooden bridges. Shallow streams, from daming up the ice, are rather worse than others in this respect, yet they are the most frequently crossed by these insecure structures. Bridges of a more durable construction, if not built in the most substantial manner, are likely to suffer from the same cause, if the water way has been too much diminished. The proper substitute in such localities are *suspension bridges* of iron wire. These claim the preference of all others, whether in regard to economy of first cost, or their superior adaptation to the circumstances of the locality. Over a large portion of our country the character of the streams is altogether more favourable to this than any other species of structure. The example of the new bridge at Fair Mount will, we hope, speedily be followed in many places.—*American Railroad Journal.*

NEW INVENTIONS, IMPROVEMENTS, &c.

Improved Mode of Making Bricks.—A correspondent of the *Railway Times* describes a simple method of making bricks adopted on the Great Western Railway on Mr. James Bedborough's contract at or near Marston. It is the invention of Mr. W. B. Pritchard, Esq., Civil Engineer of this Railway, and late of the Chester and Crewe Railway, &c., is as follows:—The clay, only watered, is thrown into a common pug mill (or mortar mill); there it is ground in a similar manner to mortar; the bottom of the mill is divided into four quarters. into which are grooves cut, and under which are placed four moulds of the same kind as those in common use by hand-moulders. Two boys are at the quarters taking the moulds out and placing others in; and by a peculiar knife at the bottom of the mill, which presses the clay into the mould, eight bricks are made every time the horse goes round, which is twice a minute; and at that rate the horse can travel twenty miles in twelve hours, thus making 960 an hour, or 11,520 per day. The bricks made by this machine are much heavier and sounder, and the clay much better tempered, than by any other mode of manufacturing that I have ever witnessed; and the saving is 2*s.* 6*d.* per thousand, besides other advantages, &c.

Moses Poole, Lincoln's-inn, *improvements in apparatus applicable to steam-boilers, in order to render them more safe, March* 11.—The first improvement consists in a mode of applying to the boiler, as a species of safety valve, a metallic plate or disc, which shall burst when the steam in the boiler attains a certain degree of pressure, and thus relieve the boiler, which plate may afterwards be replaced with a fresh one, without stopping the working of the engines. To an aperture in any convenient part of the boiler is fixed a curved tube, terminating in an enlargement or cup, having a ledge running round the bottom for the safety disc to rest upon. Upon the disc is laid a ring, the edge of which is chamfered off, so as not to cut the disc, and this ring is secured down firmly by another ring, which is screwed into the upper part of the cup. The outer bend of the pipe contains water, both above and below the disc, in order to maintain it at the same temperature on each side. On any convenient part of the bent pipe, is fitted a cock, by closing which, the connection of the cup with the boiler is shut off, and another disc may then be replaced without stopping the operation of the engines. The second improvement consists in the application of a steam whistle, to give notice when the surface of the water in the boiler is below a certain point. The whistle is of the ordinary kind, and the aperture by which it communicates with the boiler is closed by a stem, at the lower part of which is a float, composed of cork, or some light wood, and covered with copper. When the water gets too low, the float and stem descend with it, and the aperture being thus unstopped, the steam rushes out through the whistle, and gives notice of the deficiency.—*Inventor's Advocate.* [Many years since a plan was adopted of having a disc or plate of copper or other metal attached to some part of a boiler, which was made weaker than the boiler, so that if there should be too great a pressure on the boiler, this disc would rend asunder and permit the escape of the steam, and, in some cases, allow the water within the boiler to flow on to the fire and extinguish it. With regard to the second improvement—a steam whistle has been adopted some time past in this country, and a plan very similar to the one described above, was adoptedby Messrs. Maudslays and Field, for the engines, at the water works at Brentford.—See Journal, vol. I., page 375. Ed. C. E. and A. Journal.]

Electro-magnetic Engines.—A new galvanic battery, called the mechanico-chemical battery, has lately been invented by Mr. A Smee. of the Bank of England, which promises to supersede the other forms now in use. Its principle is simple. as its power depends entirely upon finely divided platinum, deposited by means of a simple galvanic arrangement upon any other metal which is unacted upon by dilute sulphuric acid, the only fluid used. At present he finds that silver or plated copper answers admirably for the reception of the platinum, but iron, when platinized, has the same power for a time as these metals, though the iron becomes gradually dissolved. He also finds that with his battery porous tubes can, in most cases, be dispensed with, and that the battery can be advantageously made in any of the various forms hitherto employed. Its effects are more powerful than those of the sulphate of copper batteries, and in action it is less expensive. The practical application of galvanic batteries, except as an instrument of research in the laboratory of the student, is principally confined to the explosion of powder under water, or in other mining operations, for which purposes it appears useful, from its being small in compass, and requiring scarce any manipulation. Whether it may ever be used for locomotive purposes, still remains doubtful, but who knows whether in future ages electro-magnetic engines may not take the place of steam-engines.—*Atlas.*

On a simple mode of obtaining, from a common Argand Lamp, a greatly increased quantity of Light, by Sir J. F. Herschel.—The following simple, easy, and unexpensive mode of greatly increasing the quantity of light yielded by a common Argand burner, has been used by me for some years, and is adapted to the lamp by which I write, to my greatly-increased comfort. It consists in merely elevating the glass chimney so much above the usual level at which it stands in the burners in ordinary use, that its *lower* edge shall clear the *upper* edge of the circular wick by a space equal to about the fourth part of the exterior diameter of the wick itself. This may be done to any lamp of the kind, at a cost of about sixpence, by merely adapting to the frame which supports the chimney four pretty stiff steel wires, but in such a manner as to form four long upright hooks, in which the lower end of the chimney rests; or, still better, if the lamp be so originally constructed as to sustain the chimney at the required elevation without much addition, by thin laminæ of brass or iron, having their planes directed to the axis of the wick. The proper elevation is best determined by trial; and as the limits within which it is confined are very narrow, it would be best secured by a screw motion applied to the socket on which the laminæ above mentioned are fixed, by which they and the chimney may be elevated or depressed at pleasure, without at the same time raising or lowering the wick. Approximately it may be done in an instant, and the experiment is not a little striking and instructive. Take a common Argand lamp, and alternately raise and depress the chimney vertically from the level where it usually rests, to about as far above the wick, with a moderately quick but steady motion. It will be immediately perceived that a vast difference in the amount of light subsists in the different positions of the chimney, but that a very marked and sudden *maximum* occurs at or near the elevation designated in the commencement; so marked, indeed, as almost to have the effect of a flash if the motion be quick, or a sudden blaze as if the wick-screw had been raised a turn. The flame contracts somewhat in diameter, lengthens, ceases to give off smoke, and attains a dazzling intensity. With this great increase of light, there is certainly not a corresponding increased consumption of oil: at least the servant who trims my lamp reports that a lamp so fitted consumes very little, if any, more oil than one exactly similar on the common plan.—*Phil. Mag.*

Steam Boilers.—At the last sitting of the Society for the Encouragement of National Industry, and on the report of M. Séguier the younger, a gold medal was decreed to the elder M. Chaussenot, for an apparatus to render the explosion of steam-boilers impossible. According to the report, his invention is perfect, both as regards its improvements on the safety-valve, and an ingenious contrivance to give notice to the crew and passengers of impending danger. Even the contingency of wilful mischief is provided against; as in the event of all the warnings of his machinery failing, or being disregarded, the steam flows back upon the furnace, extinguishes the fire, and destroys all possibility of an explosion.

Turning Lathes.—At an ordinary meeting of the Society of Arts, the large silver medal was awarded to Mr. J. Hick, jun., of Bolton, for an improved expanding mandrel for turning-lathes. It is necessary that a mandrel should fit so accurately, as to bite on the inner surface with a force sufficient to counteract that of the tool, and, in the ordinary mode, the same mandrel cannot be used for two pieces which are of different diameters. Consequently, in many engineering establishments, a stock of mandrels is kept, amounting to 600 or 700. Mr. Hick purposes to do the same work with eight sizes of the mandril, from one inch and a quarter to ten inches. He effects his object by having the spindle of the mandril shaped on the frustrum of a cone, on the face of which are four dove-tail grooves to receive wedges, the under faces of which have the reverse inclination of the cone, so that the lines of their outside faces are always parallel with the axis of the mandrel. A nut is screwed on the spindle, which acts on the wedges through the medium of a conical cup, which drives them up to their bearings inside of the work.

The Retarder.—Full trial has now been made of this valuable invention of R. W. Jearrad, Jun., Esq., for retarding (not locking) the wheels of carriages when going down hill. Mr. Dangerfield, coach proprietor, having had it applied first to one of his Southampton coaches, and afterwards to the Shrewsbury coach, and in both cases with the greatest success. The principle of the invention is pressure so applied to the nave of the wheel as to retard its motion, or at the will of the coachman stop it altogether. The advantages of the invention are, that the power may be applied at the discretion of the coachman, so that he might take his coach down a steep hill, without allowing his horses to be pressed upon at all. This invention reflects great credit upon Mr. Jearrad, and we hope it will be extensively applied to our four wheeled carriages, for it will contribute materially to the safety of the public.—*Cheltenham Journal.*

Porcelain Letters.—A patent has lately been taken out for an invention to supersede the ordinary wooden letters usually fixed upon the facia of shop-windows. The new letters are made of porcelain, of every form and. hue, and when fixed up, present a beautiful and attractive appearance. The facility of cleansing them is not the least of their qualifications; for with a sponge they are immediately brought to their pristine beauty and elegance. It is stated that they will not exceed the old wooden letters in price. Some of the patterns are very elegant, particularly the golden ones, and, being glazed, present a dazzling and animated appearance. They are not quite ready for public use, but it is expected they will soon arrive from the manufactory in Staffordshire.

New Fuel.—The Rev. Mr. Cobbold has invented a fuel composed of peat and the common refuse of gas tar, which burns with a bright flame, little or no smoke, and gives out an intense heat. It has no smell whatever, and has been tried in a grate, in comparison with coal. According to this experiment, which was made by a chemist, but without weighing the fuel, two quarts of water were evaporated in 35 minutes, leaving a good fire afterwards; while with Newcastle coal it took 51 minutes, leaving a low, burnt-out fire. Mr. Cobbold says he can render this fuel at *7s.* per ton.—*Railway Magazine.*

A New and Effectual Method to Kyanise Timber.—Within the last two or three weeks the Manchester and Birmingham Railway Company have commenced Kyanising their wood sleepers in a much more quick and effectual manner than by the old mode of simply depositing the timber immersed in the prepared liquid. The company have had made a large iron cylindrical vessel, weighing about ten tons, and which is about thirty feet long, and six or seven feet diameter, made from wrought-iron plates, five-eighths thick, and double rivetted, which vessel is capable of resisting a pressure of 250 lbs. on the inch. The vessel being filled as compactly as possible with wood sleepers, twelve inches broad and seven inches thick, the liquid is then forced in with one of Bramah's hydraulic pumps, and worked by six men to a pressure of 170 lbs. on the inch. By this means the timber is completely saturated throughout in about ten hours, which operation, on the old system, took some months to effect.

Extraordinary Manner of Manufacturing Cloth.—A gentleman, residing at present in London, has just obtained, we are told, a patent for making the finest cloth for gentlemen's coats, &c., without spinning, weaving, or indeed without the aid of any machinery similar to those processes, and at a cost less than one-fourth the present price. The most extraordinary circumstance in this contrivance is, that air is the only power used in the manufacture of the article. The ingenious inventor places in an air-tight chamber a quantity of flocculent particles of wool, which by means of a species of winnowing-wheel are kept floating equally throughout the atmosphere contained therein; on one side of the chamber is a net work of metal of the finest manufacture, which communicates with a chamber from which the air can be abstracted by means of an exhausting syringe, commonly called an air pump, and on the communication between the chambers being opened the air rushes with extreme vehemence to supply the partial vacuum in the exhausted chamber, carrying the wholly floccula against the netting, and so interlacing the fibres, that a cloth of a beautiful fabric and close texture is instantaneously made. Several of the specimens of this cloth that have been shown to scientific gentlemen and manufacturers have excited great admiration. This cloth is a species of felt, but instead of adopting the old laborious method, the above, which is denominated the pneumatic process, is used, and produces the result as it were by magic.—*Observer.*

ON THE CONSTRUCTION OF LIME KILNS.

BY SIR C. G. STUART MENTEATH, BART.

Having been engaged in burning lime for the supply of an extensive district of country for agricultural improvements, and being distant from coal 16 miles, it was desirable to find out the best constructed kiln for burning lime with the smallest quantity of coal, and having been aware from experiment that the kilns generally employed in Great Britain for burning lime are of a construction too narrow at bottom, and too wide at top, many kilns of this construction being not more than three or four feet wide at bottom, and 18 feet wide at the height of 21 feet, were found to waste the fuel during the process of calcining the lime, or in other words, did not produce more than two measures of burnt lime shells for one measure of coal; but it is to be understood, that in whatever construction of kiln lime is burnt, the fuel required to burn limestone must vary according to the softness, or hardness, or density of the stone, and the quality or strength of the coal used. The same measure of coal in Scotland called chews, when employed, will burn a greater quantity of lime in a given time than the same quantity or weight of small coal, the chews or small pieces of coal admitting the air to circulate more freely through the kiln. Though this fact should be well known to lime-burners, yet they frequently employ small coal in burning lime, from its being procured at a less price, though really at a greater expence, as it requires a much larger quantity to produce the same effect, and a longer time to admit of equal quantities of lime being drawn out of the same kiln in a given time.

For a sale of lime for agricultural purposes in a limited district, I have found kilns of small dimensions to be most profitable; the construction of a kiln I have employed for many years was of an oval shape, five feet wide at bottom, widening gradually to six feet at the height of 18 feet, and continuing at that width to 28 feet high from the bottom. A kiln of this construction has been found to burn lime in much less time, and with a smaller proportion of fuel, than kilns of large dimensions, narrow at bottom and wide at top, as heat is well known to ascend more rapidly in a perpendicular than in a sloping direction, from which arises the superiority of a narrow kiln, with sides nearly perpendicular, compared with one with sides that slope rapidly.

Those narrow kilns will admit of being drawn out of them every day, if fully employed, more than two-thirds or nearly three-fourths of what they contain, of well burnt lime, and afford fully three of lime-shells for one measure of coal, when large circular kilns will not give out more than one half of their contents every day, and require nearly one of coal for every two measures of lime burnt. In a country sale of lime, the quantity sold every day is liable to great fluctuations; two or three cart loads will sometimes only be required from an establishment which, the day before, supplied forty; and as lime is known to be a commodity, when exposed to the action of air, which becomes more bulky and heavy, and in that state does not admit of being carried to a distance without additional labour, it has been an object of importance with me to find out a construction of a kiln which will allow of lime being kept for several days without slacking, aud at the same time to prevent the fire escaping at the top of the kiln, if the kiln stands 24 hours without being employed, especially during the autumn and winter when the air is cold and the nights long. I now employ kilns of an egg shape, and also oval; the oval-shaped kilns are divided by arches across the kiln, descending four feet from the top: the object of the arches across the kiln is to prevent the sides of the kiln falling in or contracting, and also to enable you to form circular openings for feeding in the stone and coal at the mouth of the kiln; upon this plan, a kiln of any length might be constructed with numerous round mouths. From the great expense attending the driving of fuel from a distance of 25 miles from my own coal-pits, I have adopted the practice of cokeing the coal, which is a saving of two-fifths of the weight, and I find that an equal measure of coal and coke have the same quantity of heat in burning lime, which is somewhat paradoxical, but not the less true. The coal is found to have little effect upon the stone till it is deprived of its bitumen, or is coked in the kiln; for, during the time the smoke is emitted from the top of a lime kiln, little or no heat is evolved; or, in other words, does not the smoke carry off the heat, which is not given out from the smoke till it is inflamed, which does not take place in the ordinary lime kilns? A kiln in which coke is the fuel employed will yield nearly a third more lime shells in a given time than when coal is the fuel, so that coke may be used occasionally when a greater quantity of lime is required in a certain time than usual, as it is well known to lime burners that the process of burning is done most economically when the kiln is in full action, so as almost constantly to have a column of fire from the bottom to the top of the kiln, with as short intervals as possible in working the kiln.

Having found that limestone is apt to be vitrified during the process of calcination during stormy weather, from the increased circulation of air through the kiln, which adds much to the heat derived from the fuel employed, and which experienced lime-burners would have diminished could they be aware at all times of an occurrence of this kind: from having experience of the bad effects of too great a circulation without properly providing against it, I have reason to believe that by having a power to throw in at pleasure an additional quantity of air into the bottom of a lime kiln, a considerable saving of fuel necessary for the calcination of lime would take place, and another object would be gained, that of cooling the limestone in the bottom of the kiln, which frequently retards the drawing out of the burnt limestone for some hours, or until the limestone is so cold as not to burn the wooden structure of carts.

In working a kiln with narrow circular mouths, the stone and coal should be carefully measured, so that the workmen can proportion the fuel employed to the quantity of stones, and it is obvious, that the quantity of coal to be used must depend upon its relative quality, and the hardness of the stone to be burnt. If this measure was adopted in kilns of any construction, the lime shells would be found better burnt.—*The Dublin Advertiser.*

STEAM NAVIGATION.

The President Steam Ship.—This vessel, the largest ever yet built, arrived here a few days ago under the command of Captain Kean, and is now lying in Sloyne. She is an exceedingly beautiful model; built of the best material that England and England's wealth can supply, and is in every respect a noble vessel. She is now, (her engines not being yet on board,) what is in nautical term, called "light"; and loomes very large. Her proportions are, however, such but for the comparative size of the Queen's mail ships near her, she is so compact that she does not appear at even a short distance to be larger than the "Liverpool." A nearer approach, however, undeceives the beholder, and a visit on board, realizes to its fullest extent the conception of "a wooden world."

She is painted in man-of-war style, with gun ports, and is handsomely rigged as a three-masted schooner, with a foremast, foretopmast, and topgallantmast, approximating to those of a ship. Her bow is fine, and at the extremity of her headrails will be placed, when completed as a figure-head, a bust of Washington, the hero of American independence. Her stern is projective, beautifully formed to turn off a heavy sea; ornamented aloft with the arms of England and America, quartered in heraldic shield, supported by "the Lion of England," and "Eagle of America." The paddle boxes are comparatively very slightly raised above her bulwarks; and her general appearance is, when her side is viewed, that of a first class frigate of extraordinary size, her light rigging given her at the same time a most rakish and mischievous appearance.

The following are the dimensions:—

	Feet.	In.
Length over all, from taffrail to figure-head......	273	0
Beam within the paddle-boxes	41	0
Breadth from outside of paddle boxes............	72	4
Depth of hold	30	0
Height between the main and spar deck	8	6
Height between lower and main deck (both flush)	7	8

Tonnage supposed 2500.

Those who are versed in maritime affairs will readily conceive from these dimensions that we are warranted in stating 'that the President, is in reality, "a wooden world." She is indeed, more—she is a world not only of wood, but of iron, copper, and other materials, constituting the *ne plus ultra* of strength in naval architecture.

The President was built at Limehouse, London, by Messrs. Curling and Carter, the latter gentleman superintending her construction throughout. Between decks and in her holds she presents a perfect picture of strength; and we cannot more highly compliment our metropolitan friends and contemporaries in Translantic Steam Navigation, than by stating that they seem in materials, in fastenings, and in putting together, to have taken a leaf out of the book of our townsmen Messrs. Wilson and Co., whose vessels both in point of strength and sailing have hitherto borne the bell.

Every available modern improvement has been taken advantage of in the construction of the President. In addition to a remarkably strong frame, solid to the bilge, she is diagonally fastened fore and aft with iron and wood, in a manner that would seem to defy the rudest assaults of the ocean wave. We have not time to enter into details. Suffice it to say, that the materials of the *President* throughout are of the best quality, and that the utmost science, in a scientific age, has been exerted to work them to the best advantage.

The engines for this vessel will be of about 600 horse power. They are already built by our townsmen Messrs. Fawcett and Co., and present a splendid specimen of the ingenuity and enterprise of the age.

The *President* will present peculiar advantages for passengers. Her spar-deck will afford a long and delightful promenade in fine weather, and during rain or storms a dry and sheltered walk may be enjoyed below.

The cabins are not yet fitted up. The principal or stern saloon will be eighty-seven feet in length; its breadth (including the small state rooms on each side) forty-one feet.

No expense has been spared to render the *President* a crack ship. In strength of materials and fidelity of workmanship, she is fully equal to any of her Majesty's ships of war; and is fitted up with all the modern improvements in pumps, tanks, &c. She is also divided into sections, so that the springing of a leak (should such take place) would be attended with comparatively trifling danger. It is calculated that the *President* will carry 1,000 tons of goods beyond her compliment of coals, luggage, and materials for a trans-Atlantic voyage. Her steering tackle is of novel and improved construction; and such was required; for, from her length and size, she may be deemed a floating island.

The agents of the *President* at this port, are Mr. Pim, of the St. George's Steam-packet Company, and Mr. Macgregor Laird, brother of Mr. Laird, of North Birkenhead, the celebrated builder of Iron ships.—*Liverpool Courier*.

The Sons of the Thames.—This vessel which we noticed in the last January number is now fairly before the public, and fully sustains the speed we then announced; she eclipses all the Gravesend steamers.

Steam-Packets to the West Indies.—The directors of the Royal Mail Steam-Packet Company have, with laudable promptitude, contracted for the building and machinery for the requisite number of steamers. Three are to be of 1250 tons burden, and are in regard to the form and the cabins, of a superior construction. They will be ready for sea in the autumn of next year, when our splendid colonies in the West Indies will be brought practically as near to us as were, not long ago, many parts of the United Kingdom to the metropolis. It would be difficult to exaggerate the beneficial effects which may flow from this change, but we shall not dilate on the subject at present. Many of our readers are aware that some controversy has arisen about the route that ought to be adopted with a view to the convenience of all the interests concerned, and it is doubtless a question which deserves full consideration. We understand the Government has the power of altering the course of the packets as circumstances may render expedient.—*Colonial Gazette.*

Steam Mail Packets.—Government having ordered a weekly mail to be conveyed by steam from Hull to Christiansand and Gottenburgh, a contract for the transit has been taken by Messrs. Wilson, Hudson, and Co., of this port, and by whom two competent steam-vessels, of the first class, will be immediately placed on the station. The service is to commence on the 2d of next month. The passage which will be imperatively undertaken at specific hours, to and from the Eastern ports, will afford a safe and certain conveyance, and thereby give an additional impetus to commercial enterprise.—*Hull Times.*

British Queen.—This noble vessel arrived at Portsmouth, on Thursday morning, 16th ult., in 14 days from New York.

The "Lee" Iron Steam Barge has been fitted with Halls patent reefing paddles, and at the beginning of last month made several trips on the Thames, off Greenwich, to show the action of reefing the paddles, both when the barge was laden and unladen. The action is very simple, in outward appearance the paddle wheel being similar to the common one,—although upon inspection it will be found very different. On the shaft of the wheel is a large iron disc about 2 ft. 6 in. radius, composed of two plates of metal; the inside face of one of them, contains a spiral groove, in which plugs are accurately fitted, and fixed to the inner end of sliding arms of iron. These arms are attached at the other or outer end to the float boards, when it is necessary to contract the size of the wheel; the disc is turned round by the aid of a winch, and as it turns round, the plugs fitted to the spiral are gradually drawn up, as the radius of the spiral groove gets smaller; and when it is requisite to enlarge the diameter, the disc is turned in the opposite direction, by this means the plugs attached to the moveable iron arm are gradually drawn into the spiral groove of a larger radius and fores out the float boards. By this simple contrivance, the wheels of the "Lee" can be contracted from a large diameter to a small diameter. For such a vessel as the "Lee" it is highly valuable, as she is to be engaged by the spirited proprietor, Mr. Lee, the extensive lime burner and brick maker, to convey lime from his works up the Medway to London, and occasionally to be employed as a tow boat for bringing up the other vessels when the wind sets directly against them, sometimes this is his case for several days, and we have known instances of London being almost without a yard of lime. We have no doubt this spirited effort of Mr. Lee will cause several iron barges to appear on the Thames before many months have passed over. The "Lee" is an iron vessel built by Messrs. Ditchburn and Mair, and furnished with two oscillating engines by Messrs. Penn and Son of Greenwich:—the various experiments proved very satisfactory.

ENGINEERING WORKS.

WESTMINSTER BRIDGE.

In a former number (23), we described briefly the construction of this interesting bridge, and the works that had been carried on for many years by the late Mr. Telford for protecting its foundations, rendered insecure by the removal of old London bridge. We also explained the extent of improvements contemplated by the commissioners, and the manner in which they were being executed by Mr. Cubitt, contractor, under the direction of Messrs. Walker and Burges.

We have now the gratification of recording the rapid progress of the works, and of congratulating the public on the immense advantages they are likely to derive from the enlightened views of the Commissioners, who in addition to the extensive improvements referred to, have decided on widening the roadway 12 feet, thus making it equal in width to London bridge. The two piers that were inclosed in the dam have been extended for that purpose, and five courses of the soffit of the arch on each side already completed. The difficulty of executing this work can be appreciated only by those who are acquainted with the construction of the foundations on caissons, and a description of the method adopted must be interesting.

By referring to the plan and section in the number alluded to, it will be seen that the intention then was to carry the sheet piling completely round the pier, at a short distance from the caisson to prevent the condensed ground disturbing the framework, afterwards to fill up this space and the openings in the grating with brick, and thus form a solid bed for the Roche Portland pavement. This was done as far as the angles of the south cutwater—the part of the caisson at that extremity was then partially removed, and bearing piles of beech, 10 feet long by 9 inches diameter, driven 3 feet apart over the space on which the extended pier and cutwater were to be erected, and the sheet piling continued round; on the bearing piles were spiked double sills of memel fir crossing over the piles, and of scantlings to bond with the caisson, and form a grating the same height, the openings were filled up with brick, and 6 in. York landings, upon which a course of Roche Portland stone was laid, extending over the whole space, and bevelled off towards the sheet piling, uniform with the pavement surrounding the pier. The Portland stone on each side of the pier was cut out to a depth of 1 ft. 6 in. and 2 feet 6 in., and courses of Bromley fall stone inserted, and carried round on the new foundations; thus the appearance of the piers and soffit of the arch, as high as the top of the fifth course from the springing, is the same as if built at one period. The north cutwaters restored by the late Mr. Telford were not disturbed.

The sluices of the dam were opened on the 13th ult. at high water, the dam having remained quite dry and secure from the time it was closed.

The work both for execution and quality of material cannot be sufficiently admired, and the piers will resist for centuries the attacks of the elements they have to contend with.

The dam round the next two piers is now partly formed, and when the water has been excluded, we promise our readers an account of the sunken pier that excited the greatest interest about 100 years ago.

Wyrley and Birmingham Canals.—About twelve months ago an arrangement was made for consolidating the Wyrley and Essington Canal Company with the Birmingham Canal Company, and we observe that on the 14th ultimo the Act of Parliament for carrying that arrangement into effect received the royal assent. This union will not only be of great advantage to the proprietors, but also to the public, as the united company are going to lay out upwards of £120,000. in making two new lines of canal to connect the Wyrley and Essington canal with the lower level of the Birmingham canal, y one of which the mines in the neighbourhood of Wednesfield and Willenall will be brought into the market; and by the other the lower part of the town of Birmingham may be supplied with coal from the extensive and valuable mines at Brownhills and Cannock Chase. — *Wolverhampton Chronicle.*

Gloucester and Hereford Canal.—About five hundred men are now employed in the continuation of the canal from Ledbury to Hereford. Nearly the whole of the first seven miles is in progress; the works at present are confined to this portion, because the supply of water will be obtained by it, not only for the new part, but also for the sixteen miles from Ledbury to Gloucester; it is therefore anticipated that this additional supply will cause a considerable increase of revenue The most important works at present under hand are the embankment across the Leadon Valley, at Prior's Court and the deep cutting at Ashberton. The weather has lately been very favourable for the work, and the great progress already made has surprised many persons; part of the line is quite finished, and light boats constructed so as to be easily moved from place to place, are now being used on the finished portion, for the purpose of shifting soil and materials. Patent bricks for facing the locks are being made at Ledbury. The bricks are very superior to any before seen in this country. They are moulded in the usual way, and when in a particular state of dryness they are forced by a heavy weight into the metal mould, which operation not only brings the brick into a perfectly true and square shape, with a fine smooth surface, but also condenses the clay, thereby making the brick stronger and more durable.—*Hereford Times.*

NELSON MEMORIAL.—On the 2d ult., the following tenders were presented and opened by the Nelson Testimonial Committee, held at the National Gallery, for the erection of Mr. Railton's column in Trafalgar-square; Messrs. Grissell and Peto, the builders, being the successful candidates.

Messrs. Grissell and Peto	£17,860
Messrs. Baker and Son	17,940
Mr. Jackson	18,200
Mr. Grundy	19,700
Mr. Hicks	20,500
Messrs. Malcott and Son	27,009

SKEW BRIDGE.—Workmen are now actively engaged in the erection of one of the most, perhaps the most extraordinary iron viaducts connected with any railway, either finished or in the course of completion, in Great Britain. The viaduct in question will cross Fairfield-street, better known, perhaps, as Travis-street, Manchester, or the Manchester and Birmingham line of railway. The great mass of substantial masonry against which the six ribs that compose the arch are intended to abut, is surprising to behold; perhaps anything more substantial, or work better executed, cannot be exhibited in the kingdom. The weight of the iron consumed in this viaduct is 540 tons, and is comprised of six ribs, each 128 feet span. The viaduct is also very remarkable for its acute angle, such angle being 24½ degrees; the width of the street being only 16 yards, or 48 feet. The only erection at all approaching to this in the acuteness of its angle is one on the London and Birmingham line, which is 28 deg. So very correct have the masonry and iron works been executed to the plan and specification, that on fitting the last segment of the first rib it was found impossible to introduce a sixpence between the joints—*i. e.* before the screws that connect the two adjoining segments were tightened. In attempting, however, to fix the last segment in the first rib, before referred to, at noon on the previous day, it was found to be fully three-eights of an inch too long, caused, as it was afterwards proved, by expansion, arising from the heat of the sun—for on the following morning, early, and before the sun's rays could have any decided effect on the iron, it was found to fit its destined place with the utmost possible precision.—*Liverpool Chronicle.*

PROGRESS OF RAILWAYS.

LONDON AND BLACKWALL RAILWAY.

[In the first volume of the *Journal*, page 109, are some comments by an "Old Engineer," relative to the proposed working of the above railway—we now have an opportunity of giving the particulars as to how it is intended to work the line, which we select from the report of the engineers, Mr. George Stephenson and Mr. Bidder, read at the last half yearly meeting of the Proprietors of the Company.]

"In consequence of inquiries, which from time to time are made, we feel that some explanation is desirable respecting the mode to be adopted in *working* the railway, and we, therefore, trust, that a few observations to render this clear will not be out of place on the present occasion.

"It is, we presume, generally known, that you intend to establish several intermediate stations between London and Blackwall, although, by the direct course of the railway, the *distance* is little more than three miles and a half. This accommodation could not be afforded on so short a line if worked by locomotive engines, without either doing away with the velocity usually attained on railways, or by having recourse to more lines of rails, which would, of necessity, involve an increase of locomotive power, and add largely both to the permanent and current expenditure. By means, however, of stationary engines, the desirable object of working intermediate stations for the convenience of passengers is easily secured.

"The plan adopted to accomplish this, is as follows:—Assuming that between London and Blackwall there are three stations, A, B, and C respectively, then the trains starting from London, and drawn by the locomotive engines, would consist of at least four carriages; the carriages might be more numerous for every station, but, for the sake of perspicuity in the explanation, we will assume for each one carriage only.

"The foremost carriage will be that destined to go all the way to Blackwall—the second, that to station C—the third, that to station B—and the fourth, that to station A. In the transit to Blackwall, station A is first reached, but previous to arriving at it, the last or fourth carriage is detached from the train, and is stopped opposite that station, whilst the rest of the train is still progressing. The third carriage is detached and stopped in like manner at station B, and so on till the carriage for Blackwall has arrived at its ultimate destination. The engines then cease working, and the rope which has been drawn from London, and is to be the means of reconveying the carriages back, is in a state of rest. While remaining so, the carriages at their respective stations are loaded and attached for their return, so that in due time when the rope is set in motion by the London engines, all the carriages are started simultaneously. The carriage which was last in the train towards Blackwall, thus becomes the first, and is attached to the rope a mile or two nearer London than the most remote carriage; and as they are all attached to the same rope, they obviously travel at the same speed, though at such a distance apart. It then follows that the carriage from station A, arrives first in London and occupies the furthest portion of the depot:—then follows the carriage from station B, and so on until the last carriage from Blackwall has arrived, when the engines again cease working, the carriages being thus left in their proper relative positions for their next transit towards Blackwall.

"To these arrangements the utmost effect will be given by the adoption of the Electric Telegraph of Professor Wheatstone and Mr. Cooke, similar to that which has been for a considerable period in successful action on the Great Western Railway.

"It is expected that the Railway when completed will afford equal facilities for the carriage of goods as of passengers; but its capabilities for the former description will not be fully developed, because until we have the double terminus in London, with the outlet on the one hand to the Dock Warehouses in Fenchurch Street, and on the other to Cooper's Row, adjoining Tower Hill, the conveyance of goods, confined as the discharge of them must be to the limited depot in the Minories, might be calculated to embarrass and interrupt the passenger traffic at that point."

North Midland Railway.—Between Derby and Rotherham (and on to Sheffield by the Sheffield and Rotherham Railway), the principal operation is laying the permanent road. A double line of rails is laid for a considerable distance north and south of Chesterfield; this part of the line will be opened early in May next. The following contracts are all completed, or very nearly so:—The Beighton, twelve miles north of Chesterfield; the Eckington, Whittington, Chesterfield, Northwingfield, and Clay Cross. On the line north of Beighton, and up to Rotherham, the Staveley, Southwingfield, Lodge-hill contracts, and down to Derby, great exertions are being made to have a double line for the opening, and a great portion of this distance is laid. The only earthwork remaining on this part of the line is finishing the sides of some of the large excavations, and completing an embankment at Ball-bridge, The stations will be completed shortly, as most of them are now roofed in.—*Notts paper.*

Sheffield and Manchester Railway.—We understand that this important line of Railway is at length about to be proceeded with in earnest. It is expected that the whole of the distance between Manchester and Glossop will be under contract during the present summer, and we think that if the Directors are supported in their efforts by the Shareholders, and supplied with funds to enable them to press forward the works with energy and spirit, they may succeed in completing and opening to the public that portion of the line in course of the summer of 1841, and thus secure at once a large and profitable traffic between Manchester and the populous manufacturing districts of Ashton, Staly Bridge, Mottram, Glossop, &c., besides that which they will derive by shortening the difficult road journey between Manchester and Sheffield.—*Liverpool Standard.*

Lancaster and Preston Railway.—We understand that the Galgate embankment, which is generally considered the heaviest work on the line, is at length finished. Mr. Locke, the engineer of the line, accompanied by the secretary, and other gentlemen, made a progress throughout the line, a day or two since, and expressed the pleasure they felt at finding the works in so forward a state. No doubt was expressed that the line would be opened for traffic early in the month of June, or indeed even earlier than that if any special occasion existed for the acceleration. Contrary to general report, Mr. Locke found the works at the Preston terminus in a still more forward state than any other parts of the line. The shareholders of the railway are in high spirits at the prospect held out by Mr. Justice Coleridge, of a return of a great portion of the assize business to Lancaster from Manchester and other places east of Liverpool, as promising a material increase to their returns.—*Lancaster Guardian.*

Travelling at the rate of Fifty-six Miles an Hour.—The ten-feet wheels attached to the locomotive engines employed on the Great Western Railway, not being found fully to answer the expectations of the directors, they have altered their plan, and in future, wheels of seven feet diameter only are to be employed. The result has been the attainment of the speed of fifty-six miles an hour. On Saturday the 28th March, the Fire Fly, a new engine on this principle, manufactured by Messrs. Jones and Company, of the Viaduct Foundry, at Newton, made an experimental trip from Paddington to Reading, and the following is a correct statement of her performance:—She left the station at Paddington at 13 minutes and 18 seconds past 11, A.M., and reached Reading at 59 minutes 43 seconds past 11, having past the first mile post at 11 hours 15 minutes and 57 seconds, and the thirty-fifth at 11 hours 58 minutes and 44 seconds, which is equivalent to one mile in one minute and 15½ seconds, or nearly 48 miles an hour. During the journey one of the tender springs broke, and caused some additional friction on the axles. The load was two carriages and one truck. At 3 hours 19 minutes and 9 seconds the party started on their return to London, with two carriages. They stopped to take in water at Twyford, which detained them 14 minutes and 44 seconds, and finally arrived at Paddington at 21 minutes and 3 seconds past four o'clock. The twenty-ninth mile post from London was passed at 3 hours 44 minutes and 50 seconds, and the second at 5 hours 16 minutes and 51 seconds, which is equal to the speed of 1 mile in one minute and 11¼ seconds, or an average 50½ per hour. The greatest speed attained was from the 26th to the 24th mile post, which was done at the rate of 56 miles an hour. This is the greatest speed at present attained in the history of locomotive power—what will ultimately be the greatest, it is impossible to foretell. Messrs. Jones and Co. have since forwarded a second engine from their works to London, and they have four others in process of erection for the use of the Great Western Railway Company.—*Manchester Courier.*

Midland Counties' Railway.—The works on this line as far as Leicester are in an extreme state of forwardness, and there is not the slightest doubt the first week in May will see the train flying over the high embankment, or through the deep cuttings, to that place. From Long Eaton to Sutton Bonnington, two lines of rails are completed—the splendid bridge over the Trent being now crossed by engines and trains of waggons, and the tunnel being also quite passable. At Sutton Bonnington there is a deep cutting beside the church-yard, and a station is building, which will require some little work, but the number of hands employed will soon complete that. Past Normanton-on-Soar and Loughborough all is finished, the station at the latter place being a very large one; but at Barrow-upon-Soar there still remains considerable cutting to be done, one place being cut down to 50 or 60 feet and not being yet completed. At Cossington there is a little work, but at Sileby this is counterbalanced by there being a total completion, comprising several very high bridges, which support the line above the village streets, and also some exceedingly deep cuttings. At Syston, the bridges and station are also nearly finished, the latter being only one story high, but still very compact, and containing plenty of room. At Thurmaston, about a mile and a half from Leicester, a piece of embankment is yet to be laid, and about a mile from Leicester there is some embankment required, but near to Leicester the works are in an extreme state of forwardness. The station is a noble one; the front facing the street is supported by five huge iron pillars. The engine house, depot for carriages, workshops for engineers, &c., are on a most extensive scale.—The bridges across the railway at Leicester, viz., across the Humberstone-road, London-road, &c. are finished, but at the top of New Walk, a tunnel is being built which will require some time to complete. About a mile and a half past Leicester, a very fine viaduct is in course of erection; and at Rugby another viaduct, not equalled by any in the kingdom for workmanship, is finished. In short, on the whole, the line may be fairly said to have sprung into being, so quick has been its progress. A new plan has been adopted at Leicester in building the bridges, viz., to build the side walls so high as to prevent any one looking over, and thus at the same time protecting numbers from accidents. The process of blasting is much practised at Leicester. In conclusion, we are sorry to add, that within the last fortnight two men have been killed on the works at separate times. A horse was also killed on Tuesday morning week, by falling down an embankment. The Directors intend giving a grand opening day when the trains run to the Rugby station for the first time.—*Notts Review.*

Edinburgh and Glasgow Railway.—This line of railway is getting on rapidly, and the tunnel in Bell's Park is getting forward at a quick rate. There are three steam engines employed at this tunnel bringing up the stones and rubbish at three holes, technically called "eyes," and a great quantity of stuff is brought up in the course of a day.—*Glasgow Chronicle.*

Great Western Railway.—This line was opened on Monday, March 30, for public traffic as far as Reading; and the day being unusually fine, attracted a large concourse of people there to witness the arrival of and department of the trains. The Company appear to have made the arrangements at this station conducive to the comfort of the passengers, as well as to the facility of carrying on a very considerable traffic in that important town. On Saturday last the Directors went down for the purpose of finally inspected the station and line, previously to their being opened to the public. The train, consisting of two carriages, and a truck, with about forty persons, left Paddington at eleven o'clock with the *Fire-Fly* engine, and reached Reading, a distance of 35½ miles, in 45 minutes, being at the rate of 47½ miles per hour. On their return with the same engine and train, after stopping at Twyford for water, they travelled the whole distance of 30¾ miles, from that station to Paddington, in 37 minutes, being an average speed of 50 miles per hour. The maximum speed obtained was at the rate of 58 miles per hour.—*Daily papers.*

South Eastern and Dover Railway.—A report has been industriously circulated by a cotemporary that a great number of men have been discharged from the tunnel works of this railway in our neighbourhood, which is calculated to create a suspicion that the company is in difficulties. We are happy, however, to be enabled to find, on the most minute inquiry, that such a presumption is entirely void of foundation. It is true that a few bricklayers have been discharged, owing to a limited supply of bricks on the part of the contractor; but at the same time, nearly 200 additional workmen have been set on at the contracts extending from Abbot's Cliff to Folkestone. On a personal inspection we find the work in a most promising condition. The Shakspeare tunnel will, we doubt not, be completed by the end of May. A large portion of the sea wall is nearly finished, and the Warren contracts are proceeding as well as the nature of the ground will permit.—*Dover Chronicle.*

NEW CHURCHES, &c.

Staffordshire.—The foundation stone of a new Church on the estate of Earl Talbot, at Salt, near Stafford, was laid on Thursday, March 26th, by his Lordship's daughter, the Marchioness of Lothian. The edifice will be built of stone in the Gothic style, and will accommodate about 250 persons.

Birmingham.—On Tuesday, March 31, the foundation stone of the new church of St. Mark, being the second of the ten churches proposed to be erected in Birmingham, was laid by James Taylor, Esq., in the presence of a large and respectable body of spectators. The spot chosen for the edifice is a beautiful and commanding site near the Sandpits gate. Messrs. Scott and Moffatt, of London, are the architects; and Mr. C. J. Brailsford, late of Huddersfield, is the builder; Mr. G. David, of Lichfield, being appointed clerk of the works. The church will be built entirely of stone, obtained from the quarries of J. F. Ledsam, Esq., of Weoley Castle, and will contain one thousand sittings, one-third of which will be free. It will be erected in the early English style of architecture, and though the moderate sum for which the contract is taken (£3,000.) will not admit of much costly decoration, the edifice will present, when finished, a very chaste and elegant appearance; and the committee have every confidence that the work will be completed in a substantial and satisfactory manner. The church will, we understand, be finished by the 1st of May, 1841.—*Midland Counties Herald.*

New Episcopal Chapel at Camborne.—On Tuesday the 10th March, the foundation stone of this building was laid by the Venerable Archdeacon Sheepshanks. The chapel, (designed by, and being built, under the superintendence of Mr. Wightwick,) is in the Early Pointed style, exhibiting, in no stinted degree that appropriately ornate character which should distinguish every building of its class. Indeed we understand it was to this end that Mr. Pendarves increased his subscription from £300 to £500. The building is intended to accommodate about 330 persons, of whom not less than 200 have their sittings free. The total length of the interior, (including the chancel and choir projections at the east and west ends) is about 82 feet: the width of the main chapel 30 feet; and its height 31 feet. The interior will derive its chief effect from the exhibition of the timbers of its ornamental roof, and the lofty arches opening before the triple windows of the chancel and choir. The approved success of this fashion in the chapel at Bude Haven, erected some years back by the same architect, has induced him to repeat it in the present instance. The chapel is expected to be completed in eighteen months from the present time.—*Plymouth Herald.*

Rome.—The Viceroy of Egypt has offered to the Pope four magnificent columns, each upwards of 13 feet in height, cut from a quarry of alabaster, discovered a few years ago. They are intended to adorn the new church of Saint Paul at Rome. This splendid present has been accepted by his Holiness, and is to be conveyed to Rome at his expense.

PUBLIC BUILDINGS, &c.

Cornwall.—The new Market Houses at Bodmin, Cornwall, are fast approaching towards completion. This building will form a most conspicuous improvement to the main street of the town, as it is erected upon a site of land formerly occupied by several ruinous tenements with projecting pent houses. The front is built of granite, the centre part or entrance being formed by four massive pillars in single blocks, with architraves over, 14 feet long each, weighing nine tons each; indeed, this front may be likened unto Stonehenge, as, with the exception of the ashlar and cornice, it may be said to consist of 13 massive blocks. In the architrave over the pillars are sculptured oxen heads, taken from the antiquities of Delos. The shamble fittings are to be iron, and the front enclosed with three pair of handsome iron gates. The cost of the erection will be about £3000. William Harris, Esq., of Bristol, is the architect.

Cornwall.—The new Town Hall at Helstone was opened for public business on the 14th of April, by the Recorder. This erection is in the Grecian Doric style, and cased entirely with Constantine granite; the front is composed of a basement having three entrances, viz., two to the corn markets, which are under the Guildhall, and one to the Guildhall. Above the basement are fluted granite Doric columns and pilasters, with entablature over and sculptured pediment, consisting of a clock in the centre, the band of which is composed of oak leaves and acorn-wreaths, and upon each side, forming supports, figures of St. Michael and the Dragon, being the town arms, which have been ably pourtrayed by Mr. Thos. Tyley, Sculptor, Bristol. The new General Market Houses in this town are now quite completed, and, together with the Town Hall and Corn Markets, reflect great credit upon the architect, William Harris, Esq., of Bristol. The cost of the Market Houses and Town Hall, including all expences, £6000.

MISCELLANEA.

Burning Coal Mines.—Letters and papers from the department of the Allier, bring accounts of a remarkable conflagration which broke out in the coal mines of Commentry, on Sunday the 15th March, and had been burning for a week with daily increasing fury. It appears that this fire, which, for the last four and twenty years, has been silently smouldering in the bowels of the earth—revealing its existence by perpetual smoke, and occasional outbreaks of flame, which, however, had always been confined within the limits abandoned to its dominion—had, at length, made its way through some breach into one of the vast galleries of these extensive workings; and there, meeting with the air-current so long denied it, had spread through all the subterranean chambers and passages with a rapidity before which resistance became utterly powerless; showing itself at every crevice and outlet of the vast labyrinth, and flinging its points and columns of fire far up into the air, through all the shafts that led into the wide field of the rich deposit. Luckily the solemnities of the day had emptied the workings of their human tenants, for no mortal aid could have availed them against the suddenness with which the fiery flood swept over all things. The authorities of the district were early on the spot, but have hitherto been little more than idle and awe struck spectators. Neither Vesuvius, nor any other irruption, say the accounts, can give a notion of the dreadful and sublime scene. "If," says one writer, "it were possible to forget that the flames have been, three whole days, devouring immense wealth, and that by this confirgration three hundred fathers of families will be thrown out of employment, there would be room for no other sentiment than that of admiration at the magnificent spectacle. Imagine a deep ravine, nearly circular, in the form of a reversed cone, with its edges, however, hourly enlarging. Through fourteen large openings, issuing at about twenty feet above the ground of this ravine, and giving access to the innumerable galleries of the mines below, as many torrents of flame are poured forth, with frightful violence from the cauldrons within—flames of a thousand hues, rushing forth like fiery whirlwinds—dividing, and crossing, and mingling, and rising, and falling, and rising again! At times, a hollow cracking sound echoes through the abyss; this is some huge block of coal detaching itself from the roof or sides of one of the galleries, and falling into the blazing gulf. Then rises up a thick column of black dust, till it reaches the openings of the galleries, where, pierced in all directions by the flames, long serpents of fire work through its volume from side to side. Sixty feet higher up, on each side of the galleries, two gaping mouths shoot into the air their dazzling columns of fire. Suddenly one of these ceases. It seems for a moment, as if checked in its wrath. Then comes a long and startling groan from the entrails of the earth; and forth again rushes the flame, blood red, roaring and terrible, threatening in its fury to lift up the burning mountain altogether, and bury the spectators beneath its dreadful ruins. Again, look around you; it is midnight, and two thousand human faces are there, some grouped on the opposite crest of the ravine, some sheltered in the cavities of the rocks. Yet no sound meets the ear save that of the roaring flames." The latest accounts states that the rafters of the galleries had all fallen, and the founts of flame nearly ceased to play. The whole had become one huge burning gulf. The loss is said to be incalculable; millions of hectolitres of coal had been consumed. The engineers were preparing to turn the course of a stream, which flows at a league's distance, and direct it upon the burning mountain. Workmen were employed night and day in this operation, by which it was hoped to lay the mines under water.—*Athenæum.*

The Brick Trade.—It has been recently ordered that in estimating the duty, the size of the brick shall be measured in its dry, and not in its moist, state, as hitherto. Those familiar with the manufacture of bricks will at once see the fairness of the regulation, as some clays pine in much more than others.

Model of the Church of St. Peter.—We beg to call the attention of our readers to this most elaborate work of art, which is now exhibiting in the Gallery in Maddox-street, opposite St. George's Church, Hanover-square. It is the work of Celestino Vai, who has had the boldness to come to this country, trusting in the hope that he might reap an abundant harvest, and we most heartily wish him all the success the great merit of his model entitles him to expect. We can truly say, that it gives a more satisfactory idea of the celebrated original—of its beautiful proportions and enormous size—than any painting could possibly do. It is, therefore, a most interesting exhibition, not only to those who have had the good fortune to have seen Rome, but to that class more particularly who are untravelled. It is executed in wood, on the scale of 1 to 100, and consequently takes up a considerable space in a very large room. The fidelity and beauty with which every architectural ornament is rendered, is truly surprising, and this is more particularly evinced in the numerous statues that ornament the building. Every one of these represents a different attitude, and their number, amounting to between 500 and 600, renders them an amusing study. We may here observe, that the artist has represented the building as the architects intended it to be, but, as the church is not yet finished, he has executed a much greater number of figures than are now actually placed on the building. In the centre of the piazza is the Egyptian obelisk, which rises to the height of 134 feet. Its structure of red granite is exactly imitated. The fountains too are there, and the grand flight of steps which leads to the vestibule, and all about are scattered little diminutive figures, which will serve to show the relative size of the building. The colonnades next attract the attention, and although in our opinion they are out of place, yet the fame they have acquired the architect, Cellini, is well deserved. Above all we were attracted by the glorious dome of Michael Angelo, which is indeed a wonder to look upon. This exhibition cost the artist (Vai) a labour of 11 years, to him a labour of love. The room is surrounded by a clever panoramic sketch of the most interesting objects in the immediate vicinity of this most celebrated church.

LIST OF NEW PATENTS.

GRANTED IN ENGLAND FROM 30TH MARCH TO 23RD APRIL, 1840.

Claude Joseph Edmeu Chaddron Junot, of Brewer Street, Golden Square, Operative Chemist, for "*certain improved processes for purifying and also for solidifying tallows, grease, oils, and oleaginous substances.*"—Sealed March 30: six months for enrolment.

Henry Martin, of Morton Terrace, Camden Town, for "*improvements in preparing surfaces of paper.*"—March 30; six months.

William Neale Clay, of Flimby, Cumberland, Gentleman, for "*improvements in the manufacture of iron.*"—March 31; six months.

John Lebbrecht Steinhaneser, of Upper Islington Terrace, Gentleman, for "*improvements in spinning and doubling wool, cotton, silk, and other fibrous materials.*" Communicated by a foreigner residing abroad.—March 31; six months.

Peter Bancroft, of Liverpool, Merchant, and John Mac Innes, of the same place, Manufacturing Chemist, for "*an improved method of renovating or restoring animal charcoal, after it has been used in certain processes or manufactures to which charcoal is now generally applied, and thereby recovering the properties of such animal charcoal, and rendering it again fit for similar uses.*"—March 31; six months.

Charles Cummins, of Leadenhall Street, Chronometer Maker, for "*certain improvements in barometers and sympiesometers.*"—April 2; six months.

James Stead Crosland, of Leeds, Engineer, "*for certain improvements applicable to locomotive and other steam-engines.*"—April 2; six months.

Thomas Smedley, of Holywell, county of Flint, Gentleman, "*for improvements in the manufacture of tubes, pipes, and cylinders.*"—April 4; six months.

Harrison Blair, of Kearsley, Lancaster, Chemist, and Henry Hough Watson, of Little Bolton, Chemist, "*for an improvement or improvements in the manufacture of sulphuric acid, crystallized soda, and soda ash, and the recovery of a residuum or residuums, applicable to various useful purposes.*" April 6; six months.

Richard Beard, of Egremont Place, New Road, Gentleman, "*for improvements in printing calicoes and other fabrics. Communicated by a foreigner residing abroad.*"—April 6; six months.

Edward Thomas Bainbridge, of Park Place, Saint James', Gentleman, "*for improvements in obtaining power.*"—April 13; six months.

Thomas Young, of Queen Street, in the city of London, Merchant, "*for improvements in lamps.*"—April 13; six months.

James Caldwell, of Mill Place, Commercial Road, Engineer, "*for improvements in cranes, windlasses, and capstans.*"—April 15; six months.

John Gold, of Etna Glass Works, Birmingham, Glass Manufacturer, "*for improvements in the manufacture of decanters and other articles of glass.*"—April 15; six months.

William Potts, of Birmingham, Brass Founder, "*for certain apparatus for suspending pictures and curtains.*"—April 15; six months.

Louis August de St. Sylvain Baron de Los Valles, of Nottingham Street, Mary-le-bone, "*for certain improvements in cleansing, decorticating, purifying, and preserving corn and other grain. Communicated by a foreigner residing abroad.*"—April 15; six months.

William Grimman, of Camden Street, Islington, Modeller, "*for a new mode of wood paving.*"—April 15; six months.

Joseph Whitworth, of Manchester, Engineer, "*for certain improvements in machinery or apparatus for cleaning and repairing roads or ways, and which machinery is also applicable to other purposes.*"—April 15; six months.

Thomas Robinson Williams, of Cheapside, Gentleman, "*for certain improvements in obtaining power from steam and elastic vapours or fluids, and for the means employed in generating such vapours or fluids, and also for using these improvements in conjunction with distillation or evaporation, and other useful purposes.*"—April 15; six months.

William Unsworth, of Derby, Silk Lace Manufacturer, "*for an improved tag for laces.*"—April 16; six months.

Samuel Wilks, of Darleston, Stafford, Iron Founder, "*for improvements in the manufacture of vices.*"—April 16,; six months.

William Henry Bailey Webster, of Ipswich, Surgeon, R. N., "*for improvements in preparing skins and other animal matters for the purpose of tanning, and the manufacture of gelatine.*"—April 16; six months.

Samuel Marlow Banks, of Bilston, Stafford, Gentleman, "*for improvements in the manufacture of iron.*"—April 16; six months.

Robert Cooper, of Petworth, Gloucester, Gentleman, "*for improvements in ploughs.*"—April 16; six months.

Francis Molineux, of Walbrook Buildings, London, Gentleman, "*for improvements in the manufacture of candles, and in the means of consuming tallow and other substances for the purposes of light.*"—April 23; six months.

Elijah Galloway, of Manchester Street, Grays' Inn Road, Engineer, "*for improvements in steam engines, which are also applicable to engines for raising and forcing fluids.*"—April 23; six months.

Jonathan Sparke, of Langley Mills, Northumberland, Agent, "*for certain improved processes or operations for smelting lead ores.*"—April 23; six months.

John White, of Manchester, Engineer, "*for certain improvements in vices.*"—April 23; six months.

James Malcolm Rymer, of Henrietta Street, Civil Engineer, "*for certain improvements in castors for furniture, such improved castors being applicable to other purposes.*"—April 23; six mon ths.

TO CORRESPONDENTS.

The sketch of the gothic window at Clomel Church is received, and will be noticed next month.

We do not consider Mr. Coles' *plan for propelling steam boats on canals is practicable; besides, the outlay required to carry it into execution will be too large to induce any canal company to adopt it.*

"A Subscriber" *is informed that there is a society called* "*The Contractors Association*"; Mr. Barry *of Manchester is the secretary.*

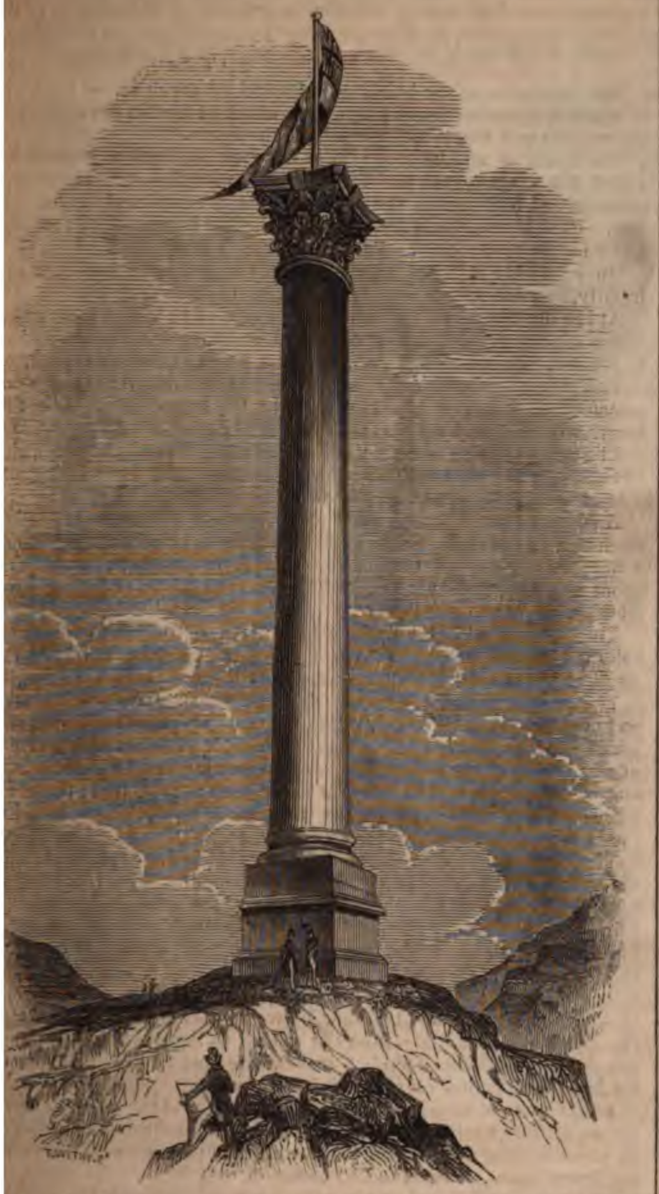
W. J. B.—*We do not think, being admitted into the Institution named will be of much service to him, until he has had some practice in a respectable office. We regret that we cannot give any advice that will be beneficial to him, for the object he wishes to attain.*

Communications are requested to be addressed to "The Editor of the Civil Engineer and Architect's Journal," *No.* 11, *Parliament Street, Westminster.*

Books for review must be sent early in the month, communications on or before the 20th (if with wood-cuts, earlier), and advertisements on or before the 25th instant.

The First Volume may be had, bound in cloth and lettered in gold, Price 17*s.*

⁂ The Second Volume may also be had, Price 20*s.*



IEW OF THE COLUMN NOW ERECTING BY GENERAL BROWNE CLAYTON, ON THE ROCK OF CARRICK A DAGGON, COUNTY OF WEXFORD, IRELAND.

The column is a fac-simile of Pompey's Pillar, but not monolithic is being constructed under the directions of Mr. Cobden the architect, granite, from the county of Carlow, with a staircase up the centre, e situation upon which it is erected is a considerable eminence ove the sea, and when finished will form a conspicuous land mark r mariners. The following are the principal dimensions of the lumn, height of base 10 ft. 4 in., shaft and base 73 ft. 6½ in., capital ft. 4½ in., total height 94 ft. 3 in., diameter of shaft at the base 8 ft. in., and at the top 7 ft. 8 in.

"This column is to commemorate the conquest of Egypt, and the events of campaign under the command of Sir Ralph Abercromby, K.B., in the r 1801, when General Browne Clayton, (then Lieut. Colonel), commanded 12th Light Dragoons, and afterwards commanded the cavalry in pursuit he enemy to Grand Cairo, taking besides other detachments a convoy in Lybian Desert, composed of 600 French cavalry, infantry, and artillery, manded by Colonel Cavalier, together with Buonaparte's celebrated medary corps, one four pounder, and one stand of colours, and capturing horses and dromedaries, and 550 camels.

The events of this campaign are further to be commemorated, by the ap-ntment of trustees under the will of General Browne Clayton, who shall ually at sun rise on the morning of the 21st of March, (when the French er the command of General Menou, attacked the British encampment before Alexandria), raise the standard on the column, and hoist the tricolour French flag which shall remain until the hour of 10 o'clock, when the British flag shall be hoisted and kept up until sunset, as a memorial of the defeat of the French, which event forms the prelude of Britannia's triumphs through a regular and unbroken series of glory and prosperity down to the battle of Waterloo, in 1815. And on the 28th of March annually, the British flag shall be hoisted half standard high as a memorial of the death of the brave commander-in-chief Sir Ralph Abercromby, who died of the wounds which he received before Alexandria, on the 21st of March 1801."

WYRE LIGHTHOUSE.

Description and structure of the Wyre (Seaward) Lighthouse, leading to Port Fleetwood.[*]

It was my study when planning this navigation to identify the remotest spit of bank turning into it, without subjecting the mariner to the treacherous, and, at best, but partially-lighting agent, a *Light Vessel;* Messrs. Alexander Mitchell and Son, of Belfast, readily took up the proposition, and the Board of Directors of the railway and harbour project, as readily adopted the application of Mitchell's ingenious mooring screw[†] to the insertion and basing of piles or pillars, in sub-marine foundation. I had given much trouble to Messrs. Mitchell, when unavailingly submitting their plans and specifications to the Liverpool Dock Committee, (Oct. 4, 1838,) of so perfect a mode of establishing lights *out upon the very* banks of a navigation, whereby the power and object of a lighthouse is enhanced by proximity with the anxious observer from sea. In fact, a lighthouse can be thus erected upon any *under-water* spit, as indifferent to a 30-feet rise of tide and channel surge, whilst sending forth its light of the same character and stability, as if on the main land; thereby throwing it more intensely and effectively *on the region required*, especially where shoals out-lie the main to any extent. Its time in erection, the shortest possible,[‡] and of so portable a structure that it may be removed, if local changes require, to another site in a month. Wherefore, then, should not every spit, now guarded by a light-vessel, with her unavoidably inferior order of lights, rendered more so in a gale of wind by pitching, floundering about, and ever and anon submerged in the trough of sea, spray, and spoon-drift, and that too when most wanted, and often at the very crisis of exigency to all around, *breaking adrift!* Wherefore not supersede them by so purpose-like a fabric? Let those who take interest, but who doubt or cannot conceive the matter, go to Fleetwood-mount Observatory, commanding the mouth of Wyre, and watch the effects of a westerly gale upon the first of its kind, (not associating the effects of a sea-way upon the Eddystone or Bell Rock, for the screw-piled pillars *do not oppose* the sea). A structure destined to save many a gallant bark that would otherwise drive, unbeaconed and unwarned, upon the sands of Morecambe Bay, and I doubt not will give rise to a general adoption; whilst rendering it imperative on local guardians of a navigation, to establish REFUGES for the cast-away mariner, on the isolated banks; since, by this method, the practicability is manifested. Indeed, this sub-marine method of commanding foundation and *hold-fast*, so ingeniously contrived by Messrs. Mitchell, combines the vital essentials to the seaman's hope, of *warning, guiding, succouring*, and, when in port, *securing!* The figure of this first '*Screw-pile*' Lighthouse in the United Kingdom,—in the world I may say, is shown in the annexed engraving, and presents to the eye a well-proportioned group of columns rising out of the sea, in the intervening and over-lapping order that hexagonal or six-angled figures produce, according to the separate angles you may be opposite to; a systematic interlacing of tension-rods renders the fabric sufficiently opaque, even below the platform; but above the platform, of 27 feet diameter, you have a six-angled dwelling-house of 20 feet diameter, by 9 feet high; on the centre of which rises the 12-sided lantern, with Chinese roof, of 10 feet diameter. Thus, you have a figure of 46 feet spread at the base, contracting at the platform balcony to 27 feet, and elevated 45 above low-water level; surmounted, as stated, by a bulky, yet pleasing and effective, superstructure, comprising a comfortable residence for the light-keepers, whilst affording you a steady, bright, *uniform* light, 45 feet above mean-sea level,—ranging over an eight-mile horizon, visible 10 miles from a coaster's deck, and freed from those *breaks* of brilliancy attending the offing passage from reflector to reflector, by being fitted with a light of '*Dioptric*' order. Foggy periods are provided for by a self-acting deep-sounding bell, tolling three strokes of five-second intervals, at one minute pauses; and tide-time for vessels of 12-feet draft, is denoted by 2 black balls being kept upon its flag-staff until 12-feet ceases upon the *straight course, right up;* at the same time, however, denoting 17 feet up through the *buoyed* channel; and vessels requiring a Wyre pilot will be understood at this lighthouse, if showing a weft at the peak, besides their pilot-jack at the mast-head; whence, a pilot-jack will *also* be hoisted until she is provided. The Wyre pilot-boats are of sloop and yawl rig, with black bottom, *white* top-sides and black streak, with her number and the letter F on the mainsail. Their cruising ground extends from Formby Point to Havering Point of Duddan.

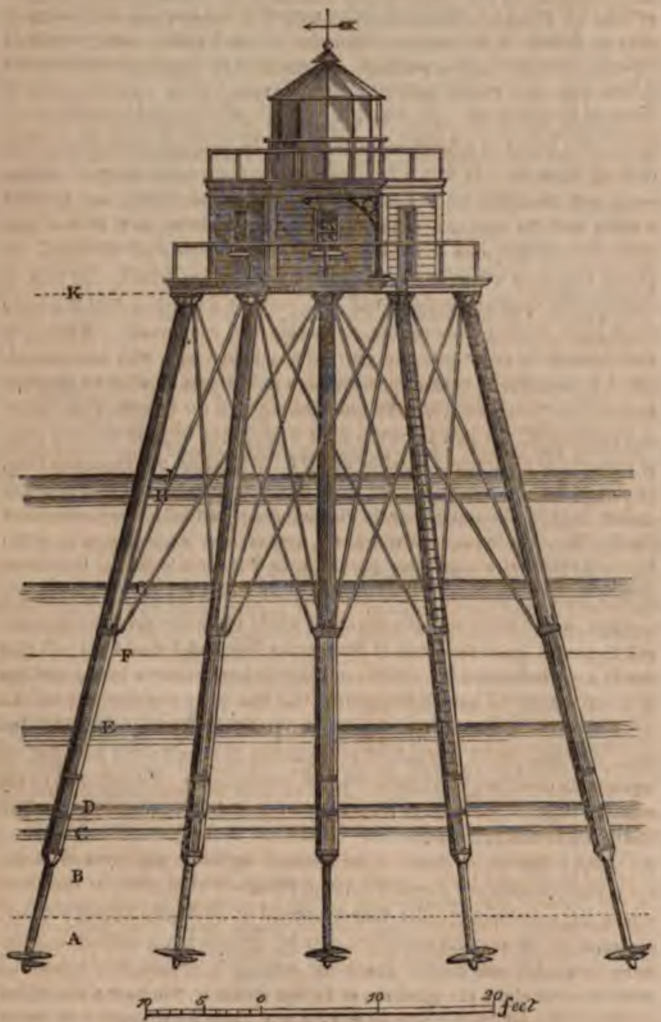
---

[*] We are indebted for this description and drawing to a very able work, by Commander H. M. Denham, R.N., F.R.S., lately published at Liverpool.

[†] See Journal, Vol. II., p. 38,

[‡] The Wyre Lighthouse was reared in two of the shortest-day months in the year, not affording *daylight* during a low-water period, spring tides, but depending on flambeaus or moonlight.

ELEVATION OF WYRE LIGHTHOUSE.



REFERENCE.

A, Marl formation; the screws are 10 feet below low water mark.
B, Sub-stratum of sand.
C, Low water equinoctial springs.
D, Low water ordinary tides, 2 feet above ditto.
E, Ditto neap tides, 9 feet ditto.
F, Half-tide level, 15 feet ditto.
G, High water neaps, 21 feet ditto.
H, Ditto ordinary tides, 28 feet ditto.
J, Ditto, equinoctial springs, 30 feet ditto.
K, Underside of platform, 45 feet ditto.
Centre of the Dioptric Light in Lanthern 60 feet ditto.

SPECIFICATION *of the above Screw Pile Lighthouse, erected on the north-eastern low-water spit of North Wharf Bank, at the entrance of the Wyre Navigation, the structure being supported upon, and secured to, the bank with Mitchell's Patent Screw Piles, of 3 feet diameter.*

The foundation of the building is formed of seven screw piles, six of which are the angles of a hexagon, about 46 feet in diameter, and the seventh pile stands in the centre of the figure.

The heads of all the outer piles have an inclination inwards, by which the diameter of the frame-work connecting the top of the columns, and upon which the house stands, is contracted to about 27 feet. Each screw pile is formed of a malleable iron shaft 15 feet long and 5 inches diameter.

On each pile a 3-foot screw is firmly keyed near its lower extremity, beneath which is placed a large drill or opening bit.

At the upper end of the shaft is a screw of 18 inches long and 2 inches diameter, for drawing down and screwing the wooden column to the iron pile, which latter stands about 5 feet out of the ground.

The columns are thus prepared;—seven logs of Baltic timber are selected, of the largest and best quality; the centre one is 56 feet in length, all the others are 46 feet.

The pedestals rise about a third of their height, and the remainder of the shafts are rounded, both for appearance and as lessening any vibration from the action of the sea.

An opening in the lower end of each column is then made of 5 inches diameter, and to the depth of about 8 feet, by boring in the manner of a water-pipe; strong iron hoops are then driven upon it, hot, the first about 8 feet up, the second about 4 feet, and the third at its lower extremity.

This hooping will give to the column greater strength than it originally possessed, especially as the wood removed by boring is the weakest in the tree, and adds scarcely anything to its actual strength.

The column being raised perpendicularly above the iron pile, the end of the latter is introduced into the opening prepared for it, and which has been made to fit accurately upon it; when the top of the pile has reached the end of the cavity, screwing on (by capstan), the foot of the column will be inserted in the bank about 3 feet; the wood, when wet, will clasp firmly on the iron, but, as an additional security, the internal screw attaches the two together.

The framing upon which the house stands is firmly secured round the centre column, and to the heads of the outer ones, by means of cast-iron capitals let down over the heads of the columns, the capitals being cast hollow for the purpose; to the abacus of these the top framing is secured with screw bolts passing down through the wood and iron, having nuts on the under side, all boring or cutting into the main support of the building being thus avoided, and the adjacent parts of the framing are bound together by wrought-iron straps and knees; the beams which radiate from the centre to the heads of the outer columns are 12 inches deep by 7 inches wide, and those which connect the head of the outer columns, 12 inches by 4.

To give lateral strength to the building to resist the effect of heavy bodies drifting against it, twenty-four angle braces from round iron of 1¼ inch diameter are applied, as shown in the plan, by which a resisting power equal, at least, to 350 tons, is presented in every direction; these braces are secured at the top to trusses cast with the capitals, and beneath to strong wrought-iron bands with projecting bolt holes; by these means boring into the columns is again avoided, the braces are keyed up at their crossing, as shown in the plan.

The light-keepers' house, which is hexagonal, is in diameter from angle to angle 22 feet, and 9 feet in height.

The centre column rises to the base of the lantern, which, with the roof, it assists to support, giving great additional stability to the whole structure.

The corner-posts of the house are 7 inches by 6, all remaining studs 6 inches by 4, beams of roof 9 inches by 5, and all outside planking, together with floor and roof of house, is 2 inches thick.

The house has an outside door and three windows, and is divided into two apartments, one having a fire-place and the floor tiled; the walls and ceiling of both apartments are lathed and stuccoed.

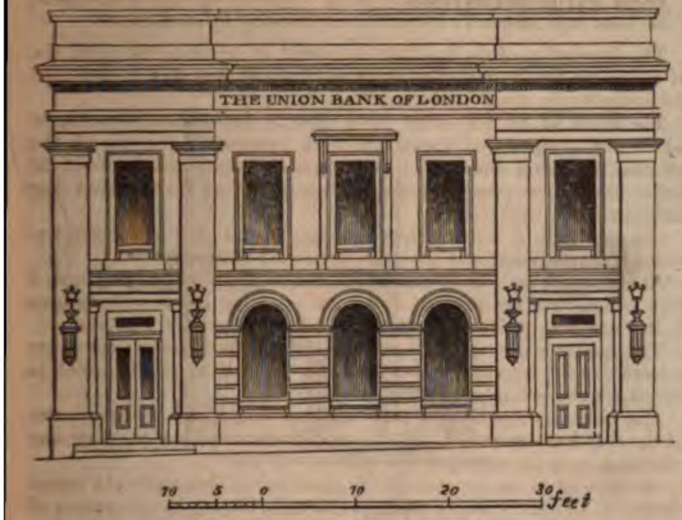
The lantern, which is 12 sided, is 10 feet in diameter, and in height to the top of the windows 8 feet, by which the lights are raised above the highest spring-tide level about 31 feet, or 44½ above half-tide level.

The lights (in this case of dioptric order) show throughout the periphery, and the roof is covered with strong sheet iron; (a lightening repeller and conductor, of course).

The light-keepers' house is covered with sheet lead, and a light iron railing is carried round the top of the building and the platform.

60, *Pall Mall, London,* HENRY MANGLES DENHAM.
Jan. 31, 1840.

THE UNION BANK OF LONDON.



The Joint-Stock Banks promise like the Assurance Offices to give some employment to architects in the metropolis, as they have already done in the country. Any thing in fact is worthy of encouragement which rises above the mere brickbat and whitewash style. This building situated on the north side of Argyle Place, Regent Street, intended to form the West-end Branch Establishment of the Union Bank of London is nearly completed, from the designs and under the superintendance of Mr. William H. Newnham and Mr. George B. Webb, joint architects to the bank. Tenders for its erection were sent in by public competition last September, when that of Messrs. Turner and Sons, of Little Moorfields, being accepted by the Court of Directors, a contract was entered into with them for building it at the sum of £3860. It occupies a frontage of 70 feet towards Argyle Place, and is three stories in height. It contains on the ground floor, a banking office 28 feet long (exclusive of circular end towards Regent Street) by 20 feet wide, and 16 feet 6 inches high, divided at one end by a screen of Bath stone Doric columns and entablature from a lobby 20 feet by 6 feet, which communicates with the Directors' Committee-room, the Manager's, and the Waiting rooms. On the basement is a groined strong-room, 18 feet by 14 feet, washing-room, &c., for clerks, porter's room, and coal-vaults. The remainder of the house is devoted entirely to the use of the Manager, who will reside on the premises, and comprises, on the first story, which is 13 feet high, a large drawing-room with circular Venetian window, a breakfast parlour, bed-room, and dressing-room, four bed-rooms and store-room on the second floor, with kitchens, wine, coal, and wood cellars, and other requisite accommodation on the basement.

Simple in its character, this building has a solidity of appearance which we trust is appropriate to the institution to which it is devoted, and it cannot fail to prove an ornament to the neighbourhood, and an example to other companies.

Dyeing Timber.—Amongst the subjects lately discussed in the French Academy of Sciences are, a discovery, by a Dr. Bourguet, for dyeing and preserving timber, and one for obtaining blue or red silk from silkworms. Dr. Bourguet states, that if the lower part of the trunk of a tree be immersed, as soon as it is felled, in a preparation of pyroligneous acid, the preparation will be absorbed throughout the whole of the tree, and that the timber will subsequently resist decay. He states, also, that if colouring matter be placed in the liquid, it will be carried through all the vessels of the tree, even to the leaves, and be permanently fixed. As this gentleman has made frequent experiments, there appears to be no doubt of the correctness of his theory. The mode of obtaining blue or red silk from silkworms is kept a secret, except as to an admission that it depends on the food of the insect. M. Flourens, a member of the Academy, had previously ascertained that the flesh, and even the bones of animals, may be coloured, by keeping them for a long period on food highly impregnated with colouring matter.

Bendable Stone.—In the Museum of the Asiatic Society at Calcutta, one object of curiosity is a bending or elastic stone. This stone is, apparently, of granite, is about two and a half feet by six inches in length and breadth, and about an inch thick. This stone, being lifted at one end, yields to the pressure, and from the half begins to bend as it is lifted, and as the lifted end is raised, the bend approaches nearer to the further extremity. On the lifting power becoming relaxed, the stone reverts to its former level.—*Calcutta Paper.*

TABLE OF ARCHITECTS.

Sir—There was more than one reason wherefore I did not give authorities for the names introduced in the Table of Architects. In the first place, I did not imagine any thing of the kind would be looked for, it not being usual to accompany Chronological Tables with similar references; in the next, an additional column would have been required for the purpose; and for reason the third, I was of opinion that to do so, would be considered coxcombical ostentation and fussy parade. I should have had to make out a catalogue of journals and books in nearly half-a-dozen different languages, Italian, Spanish, French, German, and Russian:—and to what purpose would it have been to have referred your readers to the Khudozhestzennya Gazeta for an account of Voronikhin, and of Thomond,—to the Entziktopetitzeskii Leksikon for a notice of Bazhenov, and so on? If your correspondent is desirous of meeting with a memoir of Don Ventura Rodriguez he will find one in Jovellanos' Works, but then unless he happen to possess the latter, where is he to meet with them?—certainly not in the British Museum. Of most of the other Spanish architects inserted in the Table, notices will be found in Llaguno and Cean-Bermudez, and Ponz. Relative to Quarenghi, some information may be found, prefixed to his Fabbriche e Disegni. Of Cagnola various notices have appeared in the Biblioteca and other Italian Journals, and there is also a memoir of him in Förster's Bauzeitung; while his countryman and contemporary Zanoja has obtained mention in an English work entitled "Notes Abroad," and a portrait of him may be found prefixed to the "Raccolta di Poesie Satiriche del Lecolo XVIII," which contains three of his *Sermoni*. As regards German architects, biographical or necrological notices of many of them will be found in Nicolai, Seidel, Nagler, the different Kunstblatts and other periodicals; but it is impossible here to specify the numerous authorities individually. A biography of Hirt, has been recently published in Germany; and there is a little meagre one of Weinbrenner by Aloys Schreiber, with a portrait that makes him look like a butcher. Count Raczynski's "Art Moderne," supplies us with some personal information relative to Klenze, Gärtner, and a few other architects, including Ohlmüller, whose name will be found in the table, and who has obtained a little biographical niche in the Penny Cyclopædia.—Apropos to Klenze, if the portrait given by Raczynski be a faithful one, his countenance bears a very strong resemblance to Nelson.—Having got upon the subject of likeness and portraits, I may be allowed to remark that that of Il Cavalier Quarenghi, prefixed to his above-mentioned collection of Designs, has a look of most imperturbable stupidity:—let us hope that the artist to whom he sate betrayed instead of pourtraying his physiognomy.—One omission in the Table lies heavy upon conscience, to wit, that of the name of Francis Johnston, of Dublin, architect of the Post Office, Richmond Penitentiary, St. George's Church, and other buildings in that capital, one of which is that for the Royal Hibernian Academy, which he erected in 1824 at his own private expense, and bestowed on the members;—an act of public spirit in a private individual which would here have been trumpetted in every newspaper through the country, as one of unparalleled munificence. I almost deserve to be horsewhipped for having forgotten such a man; and the more so because I have a fine portrait of him after a painting by T. C. Thompson, R.H.A., remarkable for the vigorous intellectual expression of the countenance and the animation of the eyes; on which account it forms a striking contrast to the dull fat-headed-looking phizes of Weinbrenner and Quarenghi. Just at this moment, unfortunately, I cannot refer to the Annual Register, where I could obtain the precise time of Johnston's death.

There certainly is room for doing much in the department of architectural biography both English and Foreign, for the period comprised in the Table. The greater part of the lives would be entirely new in our language. But then *cui bono?*—would more than half-a-dozen persons among the public, and about as many among the profession, care for such a work? It would be ruinous to a publisher unless he were to undertake it out of sheer public spirit, making sacrifice of the entire cost: and therefore if anything of the kind were ever to be attempted, it should be by such a body as the Institute.

W. H. L.

P.S. With regard to the names of Craig, Pilkington, Byfield, &c., whom another correspondent has pointed out as having been omitted in the Table, it is sufficient excuse to say that I have never met with them anywhere, therefore they can hardly be of any note, certainly not of any historical importance. A line must be drawn somewhere, otherwise, if all the illustrious obscure are to be included, any table or list of names would be amplified to the extent of a Court Guide, and would become quite the reverse of a synopsis for reference. Methinks, too, the party who has called attention to the above-given names, might, at the same time, have stated what are their claims to distinction.

WHITE'S PATENT BRICK AND TILE MACHINE.

Fig. 1.—Plan.

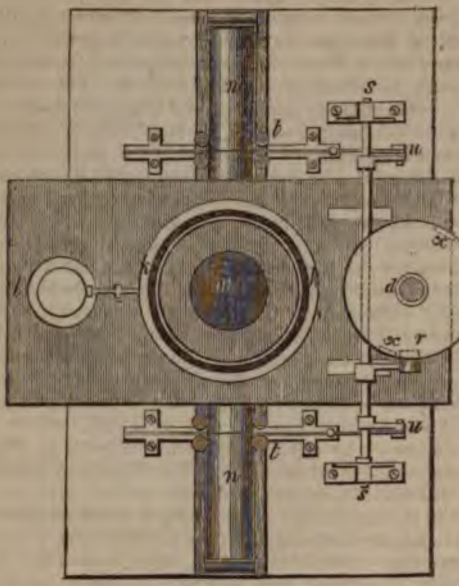


Fig. 2.—Elevation and Section.

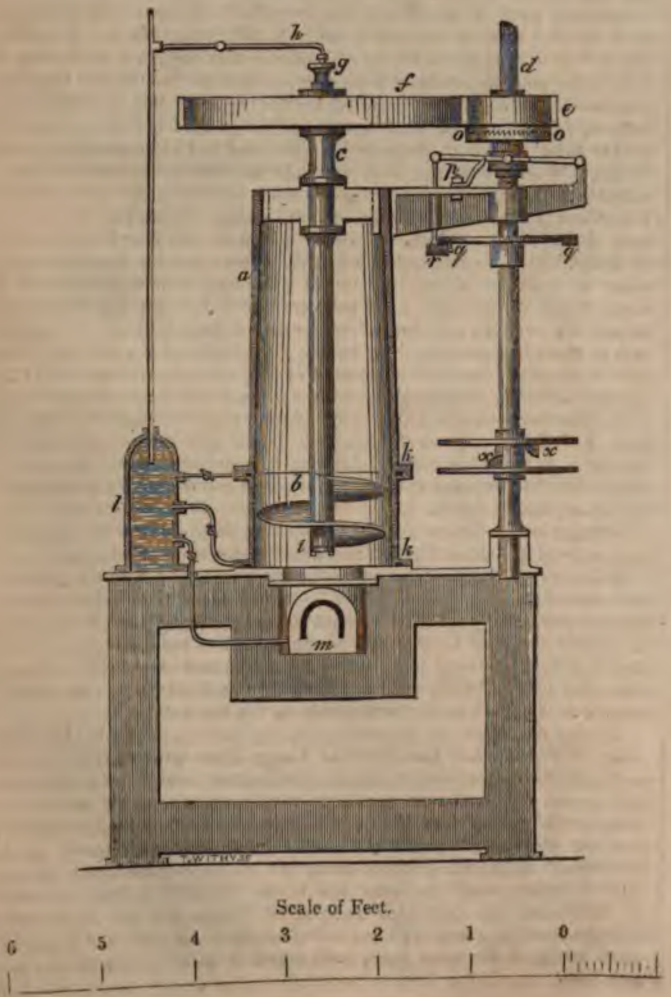


Fig. 4.—Section of Screw and Cutting Apparatus.

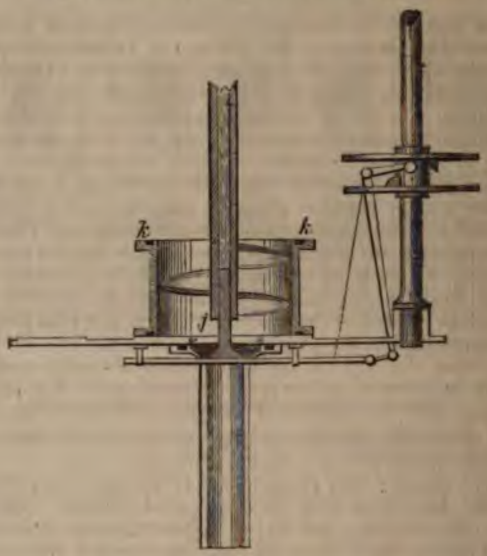


Fig. 7.—Section of pinning and clutch box.

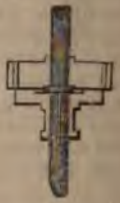


Fig. 8.—Plan of Tube-cutter.

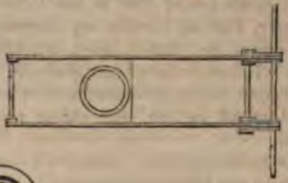


Fig. 6.

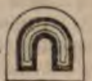
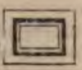


Fig. 5.



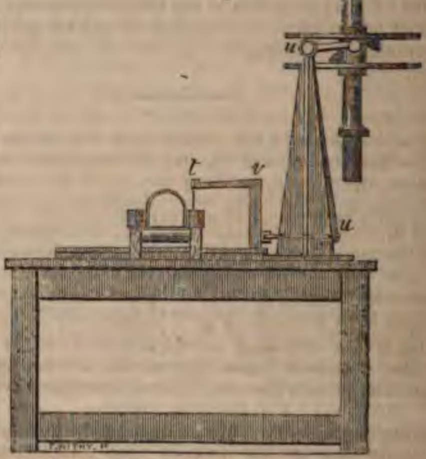


Fig. 3.—End view of Cutting Apparatus.

WHITE'S PATENT BRICK AND TILE MACHINE.

Specification of the Patent granted to James White, Lambeth, in the County of Surrey, Engineer, for certain Improvements in Machinery, for moulding Clay to the form of Bricks and Tiles, and for mixing, compressing, and moulding other substances.

The first part of the invention relates to a mode of forcing clay through moulding orifices by the pressure of inclined surfaces. Secondly, to the application of hydrostatic lubrication to facilitate the movement of the clay during the process of compressing and moulding it. Thirdly, to a mode of mixing, compressing and moulding peat; and fourthly, to a mode of compressing and expelling the water from peat-moss, by the superincumbent weight of the atmosphere.

Fig. 1 is a plan of a machine constructed according to my invention for moulding clay to the form of bricks and tiles with a portion of it removed, and Fig. 2 is an elevation of the machine with several parts of it in section, for the purpose of showing the internal construction more clearly. Fig. 3 is an end view of the cutting apparatus which divides the moulded clay into the length required, removed from its place, which is in front of the machine. There are two, one on each side, as represented by the plan, fig. 1.

In preparing the clay for moulding, when necessary to crush it, I prefer to do so between rollers grooved and ribbed. The ribs of the one working into the grooves of the other, which will break up the clay more effectually than by crushing it between two rollers, having plain cylindrical surfaces.

When the clay has been prepared for moulding, it is conveyed into the machine by the aperture a, fig. 2, on an endless band or by a shovel, or the aperture may be lower down opposite the screw b, on the hollow lubricating shaft c, and the clay impelled into it direct by the force of the crushing rollers; in this case the screw may be placed in a horizontal position, and the aperture a be above it. The power which gives motion to the machine is applied to the vertical shaft d, and by means of the pinion e working into the wheel f, the screw and shaft c are put in motion. This shaft is supported and retained by one bearing at top, and the screw b is turned and fitted to the cylinder in which it revolves at bottom. There is a stuffing box g fitted to the top of the lubricating shaft c, which receives the end of the pipe h that supplies the chamber in the shaft with water. When the machine is used for making bricks and tiles a brass plate i is screwed on the lower end of the shaft c, and prevents the water which it contains escaping in that direction; but when it is used for making circular tubes, the plate is removed, and a plug j inserted, which forms the inside diameter of the tube as shown in fig. 4, and the water is then permitted to percolate that way. The clay is lubricated from the spiral plane of the screw b, by having a radiating channel from the chamber in the shaft c, into which very small holes are drilled, for the water to escape by. There are also lubricating joints, or channels, in the flanges at the top and bottom of the cylinder in which the screw b revolve, marked $k\ k$, in the different figures, and similar joints or channels are formed round the orifices or moulding openings, from whence the clay exudes from the machine by the propelling power of the screw; and I would state that these lubricating joints or channels, may be differently constructed without departing from my invention, so long as the application of hydrostatic pressure in supplying a fluid to them is retained.

Fig. 2, l is a section of a vessel containing water from which several pipes with brass cocks on them convey water to the lubricating joints in the top and bottom of the cylinder, in which the screw revolves, and also to the shaft c, and the lubricating orifice, in the chamber m from whence the clay exudes. The clay with which the machine is charged by the aperture a, fig. 2, is drawn into the spiral plane of the screw b as it revolves, and impelled into the bottom chamber m, from whence it escapes in two streams in opposite directions as shown in fig. 1, by $n\ n$. When different figures are required to be moulded, it is only necessary to change the chamber m, and apply one having an orifice of the form wanted. Fig. 5, is face view of a lubricating orifice for forming bricks, and fig. 6 a similar view of one for making common draining tiles. In both these figures the lubricating channels round the orifices from which the clay exudes, are represented by strong dark lines.

In dividing the moulded clay into the lengths required, the screw b makes a brief stop at that moment, and consequently the clay to be cut. The pinion e is loose on its shaft, and resting on a collar as shown in fig. 7, which is a section of the pinion and toothed clutch-box $o\ o$, which turns it. When the toothed clutch-box is withdrawn from the pinion, as will be presently described, the shaft d may turn, and the pinion e with the apendage it drives remain stationary, until the clutch-box is forced up again to its present position by the spring p. It is withdrawn twice every revolution of the shaft d, by two inclined planes $q\ q$, depressing the roller r, as they alternately pass over it, as may readily be understood by reference to the drawing. These planes $q\ q$, can be regulated to cut the moulded clay to any length produced from one revolution of the shaft d, simply by increasing their number or adding to the length of their planes. In addition to this mode of cutting various lengths by my machine, the horizontal shaft $s\ s$, of the cutting apparatus shown in fig. 1, can be extended and several cutting instruments $t\ t$, fixed at given distances from each other, and all of them made to operate at the same instant. The levers $u\ u$, give motion to the slide v which carries the cutting instruments t, as shown in fig. 3, at the time the clutch-box $o\ o$ is withdrawn from the pinion e, by two quadrants or inclined planes $x\ x$, fixed on two circular plates shown on the shaft d. The dotted lines represent the vibration of the levers, and it will be seen that the clay is cut, and recut by their motion. Fig. 8 is a plan of the slide which is used for cutting circular tubes, it is moved by the horizontal shaft $s\ s$, vibrating two levers through openings in the top plate of the machine shown in fig. 1. In forming principal drains with these tubes, I recommend short circular soles to support them at the joints, the soles may be moulded after the manner described for making common draining tiles, and cut into short lengths by a circular saw after the clay is sufficiently dry for burning. The advantage of forming principal drains with circular tubes is very obvious. They are stronger with less material than any other figure having the same internal capacity, and they also offer to the water greater facility to escape, than would be the case if it were running over flat surfaces, in addition to which, the expense of procuring them is greatly diminished by my invention.

In the event of the machine fig. 1 and fig. 2 being employed for mixing, compressing and moulding peat, I apply knives on the screw shaft, and also round the circumference of the cylinder in which it revolves, making in fact an ordinary pug mill by which the materials will be mixed and blended together before they arrive at the screw, where such materials will be pressed and moulded into rectangular bricks, and may be cut by the apparatus described.

Another part of my improvements relates to the compressing of peat by the superincumbent weight of the atmosphere. To effect which I form a large vessel of any known material that will keep it sufficiently air tight, such as iron, slate, or stone, a few inches from the permanent bottom of this vessel, I place another full of small holes and support it on the former, above the one full of holes a layer of coarse cloth is spread, upon which the peat to be compressed is laid to about 12 inches deep. The length of the vessel is immaterial, provided it being sufficiently air tight. One, however, 200 feet long by 6 feet wide, would be a proper size for compressing about 40 tons of peat at one time. When the vessel has been charged, the peat is to be well blended together, which may be done after the manner clay is made to combine in forming the bottom of a canal when making it water tight, and it is also to be well pressed to the edges of the vessel, to prevent as much as possible the air descending by it, or through it, in a downward direction. When the top surface of the peat has been well secured against the admission of air, a communication is to be opened with an air pump, and the air exhausted from the space between the two bottoms which will cause a partial vacuum below the peat, and thereby offer to the water which it contains great facility to escape. At the same time the pressure of the atmosphere on the top surface of the peat will be in proportion to the exhausted state of the air below, and the whole mass will be compressed, and the water which it contains will be carried away by the air pump, after the manner the air pump of a condensing steam engine performs its office.

When the peat has remained in the vessel or pit sufficiently long to be reduced to about one-third of its original depth, it is to be removed and properly dried by any of the modes in use. In removing it, it may be readily cut into regular sizes by having a carriage to pass over it with knives projecting downwards, and so placed as to divide it into a number of slips about 4 inches wide, and these may be cross-cut into lengths of 8 inches, which is found to be a good size for drying.

Having described my improvements for moulding clay to the above mentioned purposes, and also for compressing peat, I wish it to be understood that I do not claim any of the parts, which are well known and in use for moulding clay and compressing peat; but what I do claim as the first part of my invention, is the application of the inclined surfaces of a screw to press clay through moulding orifices as above described. Secondly, I claim the mode of stopping the moulded clay while it is being cut as above described. Thirdly, I claim the mode of lubricating the clay with water when being moulded by pressure through moulding orifices as above described. Fourthly, I claim the mode of mixing, compressing and moulding peat by means of a pug mill when combined with a screw to compress and mould the peat through moulding orifices as above explained; and lastly, I claim the mode of compressing peat by the pressure of the atmosphere, and separating the water from it by a pump as above described.

James White.

11, *East Place, Lambeth,*
May 12, 1840.

ON THE HORIZONTAL AND PERPENDICULAR LINE IN ARCHITECTURE.

By Frederick East, M.A.

I was at the Institute the same evening that Sir Gardnor Wilkinson, a gentleman of great acuteness, tendered to its members certain impressions produced upon his mind by the prevalence of the horizontal or perpendicular line in architecture. Sir Gardnor, however, from a certain politeness of feeling, did not extend his observations to any length. He conveyed them rather in the shape of suggestions, with a view to elicit from the profession more enlarged views upon the subject. Probably in harmony with that wish it was that Mr. Godwin entered the field, and favoured us at the last meeting with a passing and pertinent criticism upon the perpendicular line. But the bearing of his criticism affected the frequent use of a column breaking from the main entablature and exhausting itself in a figure. He considered it as a mere excrescence, giving perhaps too much importance to sculpture, which I conceive most will admit as only accessory and secondary to the design. Hence it was employed without judgment or feeling when evidently a mere prop or support for the statue. His observations seemed, however, limited to this; they appeared to penetrate no farther than to show this fallacy in taste. I can only regret from the clearness and conciseness of those remarks that he did not anticipate my own, and that the subject was not more indulgently treated by one so much more competent to give them.

Feeling, however, that it is expedient to detect the true spirit of a composition, and of the minutiæ which compose it, in order to guide our own taste; and that no satisfaction can result from the mere knowledge of the existence of this or that style without we can apply it to our own erections, if harmonious, or shun it, if discordant; I humbly introduce my own impressions on the subject, which I offer, however, with submission to the profession, as before men, some of whom are no doubt perhaps more fitted to impart information, than to receive the slightest observation, or the smallest wrinkle from me.

By a consideration of the prevalence of these lines, so marked, and prominent in the palaces and churches of Italy, in the middle ages, we naturally trace out the real secrets of beauty in foreign creations, and are enabled to judge whether they accorded with the spirit of the times, and consequently with the beauties of real expression, as it was then influenced. By this means we may avoid passing a hasty censure upon that which to an edifice in this country would be certainly destructive to true taste, and which we could never imitate but under similar circumstances.

Notwithstanding the correctness of Mr. Godwin's remarks, I conceive a more powerful motive, than to give effect to sculpture, influenced the adoption of the perpendicular line, in the purer days of art. And that however a series of columns might have been afterwards sacrificed to the beauties of a figure or the ornaments of sculpture, their use sprang originally from the poetry of nature and the resources of Italian fancy.

I conceive that great poetry and pathos—pleasing emotions, or gloomy ideas are consequent upon a skilful appropriation of the perpendicular or horizontal lines. A partiality for the former when decked with the garlands of nature, enlivening us with gaity and mirth, and exhibiting in its tapering lightness, all that seduces and captivates; whilst great indulgence in the latter instils awe and inspires some idea of the terrible and sublime.

To illustrate my meaning more clearly, I would make solid simplicity, weight, dignity, &c. to repose upon the horizontal, whilst elegance and grace should seek their beauty from the perpendicular. Because there seems to me something of phisiognomy in architecture,—a character about it—so that we are either amazed, awed, softened, or delighted, by its mien and general bearing.

When therefore we search after grace, nature reveals it, sporting and skipping in lightness and elegance, never so beautiful as when in action and erect, seldom shortened into repose. Hence the taperings of the Gothic, and the careless lightness of the Corinthian. Hence also the prevalence of the perpendicular, which might tend to insignificance in a building, but for a certain symmetry of parts, easily detected in works of acknowledged merit. But to fashion the grand, the solemn, the imposing edifice, we instinctively turn from any thing feminine or slight. Like laughter and mirth they become noxious to our sterner moods, and nothing satisfies but a certain breadth of parts, a rigidity of aspect, a dignified reserve as we search for the sublime. Nor does any loftiness of character, nor height of form display itself, but what seems natural upon the breadth, merely in fact, a necessary proportion, to avoid contempt and ridicule. Thus perhaps it was that horizontal lines were sometimes preferred for the Italian palace; though oftener defeated in effect, by the lurking fondness which Italian artists had, for fanciful embellishment, giving occasionally an eccentric and inappropriate feature to an otherwise imposing front.

The adoption of the one style or the other results, I conceive from the spirit of the times. The artist wished to change the dull monotony of a mass, to give life and sprightly features to the building. To deck the edifice in all the fashions of elegance, sought and employed qualities in form and exterior conducive to this idea.

He knew that effective grace must depend upon the happiness of contrast, and selected the perpendicular line as the best index to variety in a front of breadth and lateral bulk. In after times the church—the Roman church was to betray the resources of its wealth;—the people were to conceive a proper notion of its splendour—the terrible and sublime were to be lost, or rather to be subdued for a little, amidst images of attraction and wonder. Hence the artist digressed, and violated symmetry, to court the spirit of the times.

Or the Ducal palace was to awe the passer by, the vassal was to shrink when near the presence of the great. Hence the judgment of the artist fed the noble's pride, by investing the edifice with all that indicated the sullenness of grandeur. The horizontal line traced itself all through the edifice, or was broken by a wing or a centre of richness and tapering forms, as if to intermix with so much oppressive dignity some picture of splendour and elegance too.

There seems no exact standard to test the merits of either grandeur or grace, yet to, a mind susceptible to and attracted by natural elegance or the pure distinctions of art, first impressions are generally most correct. Without entering however into examples which are unnecessary, if the moral of the sentiment be imbibed, and we can only trace the principle affecting the application of either to its true source, so as to assist our own ideas of correct taste and of purity in design. I shall in conclusion merely test these opposites in art, by a comparison with two opposites in nature—and would remark that as we love in woman with her laughing eye and elegance of motion, that aërial lightness, that sylphlike form, which facinates and enchants; so we expect that compactness, that breadth,—that stern solidity of air in the more dignified lord of earth. And that whereas we cede to woman with her loveliness of grace, gaiety of attire, and profusion of ornament as an increase to her charms, so we expect not to find the majesty of man masked by a whimsical dress, or cloaked by a frivolous garb. Presuming at the same time that the coldness of our fancy may lessen the contrast, and account for our giving the swellings and undulations of grace less prominence than accorded with the fire,—the energy of the ardent Italian.

Whether we transport ourselves to Vicenza and see the edifices built or restored by Palladio, or follow our own great genius of the same school Inigo Jones, into the harmonious distributions of the flat and void of the sombre and light—we see a felicity in outline, a play in effect, in which ancient beauty is reproduced and revived in combinations unknown to antiquity. This beautiful harmony seems to me the effect of lines. In the great front of the design for the Whitehall Palace, where the façade is long, we see with what consummate skill in the combination of lines, Inigo Jones pleases the eye, to a length of 1151 feet. How in the centre, column rears itself above column. How the whole centre itself is elevated—what a noble attitude it has! how rich and yet how symmetrical! Contrasted against this front of elegance comes a void where naked simplicity reigns—where little or no ornament appears—where little of what is tapering is seen—and the eye which seemed to soar up the rich and elegant columns of the centre, now wanders along the broad gloomy silent mass which intervenes.

This you see is depressed—is lower than the centre—the idea of breadth is at once visible, and the contrast with the lofty centre is apparent—and thus the effect is virtually speaking one of lines. This idea of harmonious distribution is visible in the centre itself. There to give importance to that part in so long a façade, the length of it must necessarily be great, and to remedy this Inigo Jones introduces two towers, the relief of which and their tapering appearance is very striking and effective.

As you progress along the front you catch once more the lofty wing, the columns, their statues, and the frequency of lofty lines is again seen, and your eye wanders as it were between dullness and life. This peculiarity—this attention to the varied employment of lines is peculiar to others as also to Palladio, and to be seen in his Palazzo del Capitanio and other buildings at Vicenza.

The introduction of columns in a long continuous edifice seemed not only to give the idea of support but to create variety.

Assuming this, it is somewhat singular to compare any Grecian temple with any mansion erected by Inigo Jones—or any palace erected by Palladio. We see at once by what a different method the Grecian artist produced variety in his edifice. The Greek was all simplicity—his outline was distinct, symmetrical, unconfused, and shadowless, except the portico. And variety instead of being beheld in the body and bulk of the temple, is seen rather rambling in the cornice, whilst reliefs are visible in the mouldings of the architrave, and the figures of the frieze.

To analyze this subject more closely, however, it becomes necessary to class the peculiarities of the perpendicular and horizontal lines according to time, and as seen in the various countries of architectural renown.

The descent from the classical originals in art was by a comparison with Grecian art, where symmetry ruled design to introduce extremes. And though we see effective compositions in Italy and elsewhere, we perceive that the bent of innovation was to introduce the perpendicular—only slightly seen at first—with the tendency to give altitude, appearing but faintly, gradually, and then only in a part of the edifice, undiffused.

The tower or some part en masse reared itself square, and without pilasters or columns at first even solid itself in plan, but this very contrast to the other part showed the perpendicular in its infancy. Until as the debased Roman architecture of the lower empire which forms the foundation of the Saxon, Norman, and Lombard school became successively improved in England and the north of Europe, the perpendicular found its way into those beautiful modifications, termed Gothic—and finally in the religious edifice became invested with a charm to an Englishman's fancy. For up these columns in the cathedral the eye wanders for repose, but finds itself lost in the intricate beauties of the roof, and rambling amidst the strange and the wonderful, as amidst types of the vast and incomprehensible creator.

To trace the first change from the severe to the elegant, from the breadth of dignity to the delicacy of after times. We find before the invasion of Greece by Xerxes, the Doric was the only order known. Pericles and Cimon, however, on the rebuilding of Athens, by the introduction of the Ionic order from Asia into Attica, invested the ancient massive simplicity with something of the lightness and elegance of grace. The Corinthian soon after invented, introduced more softened beauty into the taperings of elegance. The edifice before this indebted to Doric proportions for its effect, becomes now more lofty and chastely beautiful without violation to the simplicity of the whole. And this change is of great importance, when we consider in a Grecian temple that the circular of the column is in itself a relief, that the peculiarity in change is that although the result is elegance itself, as a whole the principles of the change are very slight.

Turning from Greece to other states of importance, who for convenience snatch their ideas from the polished and the civilized. The Roman appears crude at first in his attempts, alive to the beauty of Grecian proportion, but fashioning a style therefrom peculiarly his own. Unpossessed of the coolness of the Grecian, we see his ideas extending, the principles of his composition different. Unsatisfied with the novelties of ornament and recesses, he must pierce the sky—and we find the Pantheon in its dome, the bursting as it were of variety, as a grand feature (and this the result of altitude) from the cradle of ideal taste. We see here the great father of lofty turrets, tapering domes, campaniles and minarets, which with the declining power and fading grandeur of Rome became so welcome to the Italian artist.

The removal of the seat of empire to Constantinople accelerated the change—St. Sophia and its minarets betray it—and at length variety became too important. That which appears a foil to the Grecian edifice appears no longer such in the Italian. The old relics of grandeur were neglected—Venice and Pisa new-born and wealthy sought their artists from Constantinople, and the old standard of Roman excellence and pure dignity became less and less visible in the Lombard barbarians. The Saracen, the Moor, the Lombard and Italian, evince so many poor attempts to turn classic symmetry into their own love of tapering forms and fanciful outline. The Ducal palace at Venice has the very corners cut away to admit a thin column—lightness is seen here where strength should appear—a fret work of shafts is the support of an impending weight, and the whole is distortion.

Palladio however seems distinct from these errors. In the Redentore church, Venice, Palladio gives a lofty elevation—the dome diminishing in contour terminates in a figure. The dome itself is winged by turrets pierced above and capped by a cone. The whole is lofty and imposing, because pettiness in ornament is unseen; and the statues are judiciously placed uncrowded, and themselves important features, but the whole is but the grandeur of the perpendicular. In the San Petronio di Bologna a change appears, with the same love of tapering forms, the same hankering after the perpendicular we lose the grandeur of parts in the horizontal breadth, the intersections of the cornices, the play of breadths, the friezes are scarcely relieved by the height of the centre, by its diminution, by its statues, or balanced by the pyramidal terminations of the wings

The descent from the purity of Palladio was evinced by a frequency of columns, but then again to have these, induced another fashion of variety. To relieve the multiplicity of columns from offence, horizontal lines were introduced; cornices traced themselves throughout and extended their fatherly protection to a host of trifling perpendiculars. In the Baptistery at Pisa we see this, and most of those cities not removed from the pale of the remains of Roman taste, displayed this confusion of lines. Proceeding in the direction of Milan, we find Lombard Gothic and orders all united. And the miscellany, as in Milan cathedral, seems to reminds us of the full grown dignity sometimes seen in a dwarf, mixed up with his littleness of parts. Removed from the relics of classic influence we find the perpendicular gaining ground, we see the edifices of northern Europe, of Normandy, &c. beautiful and their own—elegant though profuse—lovely though intricate. Turning to Sicily we find the Normans introducing a mixture of their own with the Saracenic; and the cloisters of Monreal, the Alhambra of that country, abounding in columns twisted, spiral, light, and yet singular, a mixture of perpendicular and arch—full of wild and fanciful conceptions. In Florence we find the great exactness in the horizontal. The palaces there are so many feudal residences—edifices nearly 300 feet in length, in which the stylobate runs along the whole façade where the windows are widely apart, and the very roof frowns upon you.—The subject is a curious one, it opens a wide field of information to the antiquary and artist—but to unite these two lines is the secret of expressing charms, and we love the harmonious union as we love in the broad landscape, the lofty tree, the distant mountain, or a church tower, and thus by grasping the great principle of effect in nature, we possess the most mighty wand in creating and displaying the perfections of the beau ideal.

FREDERICK EAST, M.A.,

Leigh House, Tooting, Surrey.

EXHIBITION, ROYAL ACADEMY.

ARCHITECTURE.

It is with regret we feel ourselves compelled to commence our report by stating the present exhibition to be the least interesting one for many years past; not because it contains a greater number of inferior designs, but because there are much fewer of an attractive kind than usual. Always has there been a great deal of trash, but there have generally been many designs forming redeeming points—cheering *oases* amidst the surrounding desert; whereas, this year, the latter are both more rare and less brilliant. A desert, however, will not be thought the most appropriate simile, the walls being, on this as on every other occasion, crowded and crammed from the floor to the very top of the room. Whether this system has any influence at all upon the quality of the drawings admitted—whether some are not admitted merely because they happen to fit *nicely* into vacant places, while others are turned out because they cannot be hung up without disarranging something else, or perhaps causing a few square inches of wall to be left bare, we know not; which being the case, we are bound to presume that merit obtains preference with the Academy; yet if so, what opinion are we to form of the designs which are turned out? At all events, the Academy seems to act very naturally, because, like Nature herself, it evidently abhors a vacuum—upon its walls—no matter what is hung up in order to avoid that evil.

To be more serious—we have little doubt, for our own part, that the public are deprived of seeing much that would be creditable to the profession, solely because architects are deterred from sending drawings to the Academy, being aware that the space allotted to such subjects is so utterly inadequate, that it becomes a mere chance whether they can be received, or if they are, whether they will not be put completely out of sight, as is invariably the case with a considerable proportion of those which are received. In fact, there ought not to be more than two ranges of frames hung upon each wall, on what is technically termed the line, which space, being now generally occupied by the larger and more prominent drawings, the lesser ones, which—supposing they are worth looking at at all,—ought to be hung as near the eye as possible, are placed either so much above or below it, that it is frequently barely possible to make out their subjects. Thus the catalogue may be said to be in a great measure quite delusive, promising us what appear to be interesting subjects, and when we enter the room to look for them, we find that several are scarcely to be found out, and when discovered, all that we can discern of them is, that there is something behind a glass within a frame. In many instances, perhaps, we may lose nothing by not being able to obtain a more satisfactory inspection, but there are also others in which the being prevented from doing so is highly annoying and tantalizing. An instance occurs in the present exhibition, with regard to No. 959, "View in St. Peter's at Rome, displaying the general decorative character of the interior," by J. H. Steinmetz, which appears to be one of the most tasteful and interesting drawings in the room, beautifully coloured, and treated with the feeling both of a painter and an architect. We say "appears," because it is placed so high that it is impossible to judge fairly what it is. It may, perhaps, in consequence, look to be more elaborately finished than it really is; but then it is just as likely that we now only discern the general effect, and that the beauties of detail and execution are lost; at all events, it is provoking to meet with something seemingly so very good, so disadvantageously situated, while many things, scarcely worth notice, are thrust full in view. We should say that, considering the great size of the drawing, and the familiarity of the subject, Mr. Hardwick's View of the Railway Terminus in Euston Square, might very properly have been mounted a stage higher, more particularly as another drawing of the same building was exhibited by him on a former occasion. Inordinate space, too, is occupied by No. 944, "Remains of the portico of the Lesser Temple at Baalbec," which has hardly any right to appear in the Architectural Room at all, unless it had been elevated among the oil pictures which serve as filling up stuff to hide the upper part of the walls. It is true both Hardwick and Roberts are associates, and may, so far, have the privilege of getting better places than their neighbours; yet that is but sorry satisfaction to us who go to look at the designs the catalogue promises us. No. 942 is a drawing that ought to have been hung level with the eye, whereas, for the very reason that it is small, it is actually *floored;* so that it is impossible to examine it without stooping in a most painful attitude, there being not a single chair in this room on which a person may sit down to look at any thing so placed; which, by the bye, seems to be pretty much of a piece with the other *judicious* regulations. However, any kind of accommodation, we presume, is considered good enough, both for those who send and those who go to look at architectural drawings. Surely there must be some other room or rooms on the ground floor of the building, capable of being made use of during the exhibition for works of this class; while their being thereby kept quite apart from the pictures and other drawings would, in fact, be a decided advantage in itself. If nothing better can be done, we see no reason wherefore a line of architectural drawings should not be hung up in the hall, on a screen about five feet high, before the pedestals of the statues facing the stairs. To be sure, only a very small number could be so disposed: yet even were no more than a dozen meritorious subjects so placed, where they could be distinctly examined, it would be a great improvement, and we should feel grateful for it. We made remarks to the above effect in our very first volume, and ought, therefore, perhaps, both for that reason and because we are now convinced how utterly unavailing they have been, to desist from all comments of the kind. Yet the evil itself is so scandalous, so contrary to common sense, that we must lift up our voice against it from time to time, in the hope of thereby inciting others, and the profession generally, to take some steps towards bringing about a reform, which we can only recommend. What, we ask, is the Professor of Architecture and the Architect-academicians about, that they look upon such absurd doings without interference? Do they ever look into the Architectural Room at all? Whether they do or do not, they have equally much to answer for.

Again, we ask, what is the Professor of Architecture about? for we do not see a single drawing by him. Is his office become altogether a sinecure?—he gives no lectures, he exhibits no designs; therefore let his qualifications for office be as great as they may, they are at present quite nugatory and valueless. Most assuredly he does not follow in the footsteps of Soane, who whatever his other failings might be, was certainly diligent and zealous in the discharge of his academical duties. It is no excuse at all for him to say that Mr. Cockerell has probably been prevented by his private engagements from devoting any time to Exhibition-drawings, because, as is well known, the latter are as frequently as not made by artists employed by the actual authors of architectural designs; and we have heard that Mr. C.'s own "Tribute to the Memory of Sir C. Wren" (see our first vol. p. 254), so much admired for its pictorial effect, was the work of another hand, so that his share in the drawing amounted to no more than the idea of bringing together Wren's principal buildings into a single picture. Surely the present Professor might have allowed us to see some drawings of the Libraries he is now erecting at Cambridge, and also the design which has proved the successful one in the competition for the Randolph and Taylo Institute at Oxford; some of the rivals of which are here to be found—in the catalogue at least, if they are not all to be seen where they have been stuck upon the walls.

We do not, however, find among them any drawings of the design sent in for that building by Mr. Hallman, (author of the essay on Græco-Russian architecture, which will be found at page 93 of our present volume,) although it has been described to us, by one who has seen it, as being one of very great merit and beauty, which, to say the truth, is more than we dare affirm of any of those we here notice, for they strike us as being of a very so-soish character. Whether Mr. Cockerell's will, as it certainly ought to do, hereafter satisfy us that it was deservedly preferred to Mr. Hallman's—supposing the last to possess the taste and originality ascribed to it by our informant—remains to be seen; though we strongly suspect that originality and taste are almost the very last points taken into consideration upon such occasions.

Among competition drawings are one or two for the Royal Exchange, also for St. George's Hall, at Liverpool, and we should probably have beheld some of those for the Assize Courts also, at the latter place, had they been returned in time for sending them to the Academy. Next year, however, we shall doubtless meet with some of them, but whether with that which has obtained the first premium is questionable, because Mr. Elmes has not thought proper to exhibit his design for the St. George's Hall, though it must be poor indeed if it shrinks from a comparison with Mr. O. Jones's or Mr. Alexander's. We do not like Mr. Jones' (Nos. 97 and 1046) at all: it is in a sort of Alhambra-fashion, but after such fashion as to give us what is offensive in it, without what renders it charming. Of Mr. Alexander's we can judge only of the interior of the Hall (No. 917), but if its chief merit lay here, and it was on this account that the second premium was awarded to it, we must confess, we look with trembling towards the design which bore off the first prize. We have heard that Mr. A. himself was somewhat astonished at his success, and so too are we when we look upon this specimen of his architectural invention and taste: for it is a sort of Meeting-house affair with a few showy columns forming a gallery around the upper part like those in our modern churches, and is about as original and as classical. The gaps between the columns have certainly one advantage, which is that there would be very few of those inconvenient pillars to intercept the prospect of what the newspapers style "the galaxy of matchless beauty and loveliness" that invariably graces all festive meetings where ladies are admitted to be spectators. Accordingly we have here a display of lovely bonnets and dresses perched up in the galleries, and if such display can excuse the poverty of the architectural one, gallantry we suppose ought to get the better of grumbling. No. 977, another design for the same building by Mr. Bardwell, being a perspective view of the exterior, appears to possess a good deal of merit and some originality of character; but we are compelled to speak thus dubiously as its situation prevents its being examined,—at any rate without getting a cramp in the neck.

We meet with other competition productions in Nos. 1016 and 1001, both for the Nelson Monument, viz., the latter a model of Granville's design for a cast iron column, the other Mr. Goldicutt's colossal globe—we have heard it called "Goldy's Pill"—for the centre of Trafalgar-square—and which is mystically designated in the catalogue "A Vision of the nineteenth century"—a very taking title, no doubt.

Neither of Mr. Barry's subjects (Nos. 923 and 839) have quite satisfied, or rather both have disappointed us. The front of the Unitarian Chapel lately erected at Manchester, is undoubtedly very far above the average, and is judiciously treated inasmuch as it is not made to look like a model for a large building executed upon a small scale. Yet while there is nothing to censure, neither is there any thing particularly to admire. The other design "for the additions and alterations at Highclerc, the seat of the Earl of Carnarvon," shows the proposed conversion of a plain modern house into a mansion in the Elizabethan style, by the addition of turrets at the angles, and the refacing and decoration of the other parts. The circumstance of the architect's being fettered by the necessity of adhering to what is already erected, as regards the general form and the position of the windows, prevents us from considering this a specimen of what he would do if left entirely to his own ideas for such a subject; still we should have expected from him greater freedom and taste in the application of that style and its details, which he seems here to have merely copied, without attempting to infuse into them any originality, or in any degree, refine them. It is by far too strictly faithful to that style to be much to our taste; nor can we conceive what there is in the latter to recommend it to the favour it has of late obtained; for at any rate it is neither economy nor elegance: more likely is it to be the disgust of the soi-disant Grecian insipidities—bald and staring sash-windows with a few columns stuck upon before them, by way o portico, that has occasioned a relapse into the stiff, formal, and fantastical quaintness, and little frigid conceits of this semibarbarous manner, which, as it has always appeared to us, originated only in a blundering, awkward imitation of the Renaissance style on the continent. Undoubtedly there is frequently, in spite of all this, a good deal of piquant and picturesque in our examples of this class. The proper course, therefore, would be to study and select those qualities, carefully eschewing at the same time, all the coarse dross and rubbish, and the gingerbread puerilities among which they are found, but which certainly do not tend to give them any additional charm.

(To be continued.)

STONE FOR THE NEW HOUSES OF PARLIAMENT.

Sir—Several paragraphs on the subject of the stone to be used in the erection of the new Houses of Parliament having appeared in many of the London and provincial newspapers, which contain some inaccuracies and mis-statements, it may not be amiss to set the public right in a matter which, though not of great importance, has yet some national interest.

It is, of course, well known that the Commissioners appointed to visit the quarries, and to inquire into the qualities of the stone to be used in building the new Houses of Parliament, in their report addressed to the Commissioners of Her Majesty's Woods and Forests, after giving a variety of details respecting the numerous quarries they had visited, the buildings they had inspected, and the experiments which had been made to determine the physical and chemical properties of many kinds of stone, specimens of which had been obtained, conclude their report by stating that having weighed, to the best of their judgment, the evidence in favour of the various building stones which had been brought under their consideration, they felt bound to state that for durability, as instanced in Southwell Church, &c., and the results of experiments, for crystalline character, combined with a close approach to the equivalent proportions of carbonate of lime and carbonate of magnesia, for uniformity in structure, facility and economy in conversion, and for advantage of colour, the magnesian limestone or dolomite of Bolsover Moor and its neighbourhood, was, in their opinion, the most fit and proper material to be employed in the proposed new Houses of Parliament.

Bolsover Moor is an uncultivated and rocky waste in the parish of Bolsover, in Derbyshire, a short distance north of Mansfield, and is the property of Earl Bathurst; its locality, immediately on the publication of the Commissioner's report, became, of course, an object of great interest, both to the noble proprietor and to the various parties interested in procuring stone for the great national erection; but on a more extensive and particular inspection of the beds on the Moor, than the Commissioners had been able to make of them, they were found to be deficient in their capacity of furnishing blocks of a size and form, sufficient and proper for the purposes required in the proposed erections. New speculations, therefore, arose, and fresh hopes were excited amongst the many candidates for the honour of supplying the material for the buildings; it, however, was the fortune of Mr. Charles Lindley, of Mansfield, an extensive builder and quarry owner, to discover at Mansfield Woodhouse, about a mile north of Mansfield, another bed of the Bolsover Limestone, extending over a considerable tract, of a quality and character precisely similar to that of the beds on the Moor, and which promised to furnish blocks of a size and form suitable for the purposes intended. Mr. Lindley immediately, and upon speculation, at a considerable price made a purchase of the land, which was of little worth for agricultural purposes, though occupied for them, and having submitted specimens of the stone to the proper authorities, which, being tested, were found to possess the requisite qualities, and therefore proper to be used in the erection of the new Houses of Parliament. Shafts were thereupon sunk, to ascertain what the nature and extent of the beds were that the field contained, and the result of the trials being also satisfactory, workmen were immediately employed to get stone, and numerous blocks of considerable size and excellent form were speedily obtained.

The contractors for the works, with a professor of geology, visited the quarry, and there being every appearance that the field would yield a sufficient supply of material, a contract was entered into with Mr. Lindley, and he is now actively engaged in forwarding a regular supply of stone to London.

Mr. Lindley is also the proprietor of an extensive quarry of white sandstone (magnesio-calciferous sandstone), at Mansfield, which is also highly spoken of in the Commissioners' report for its appearance and durability; this quarry will yield blocks to the size of 10 tons, and the stone will work well with the Woodhouse (Bolsover) stone, a great advantage is thereby gained, because the sandstone may be used for purposes to which the limestone may not always be suited.

On reference to Table A in the report of the Commissioners, pp. 12, 13, it will be seen that the Bolsover stone is described as magnesian limestone, that its component parts are chiefly carbonate of lime and carbonate of magnesia, semi-crystalline, its colour a light yellowish brown, and its weight, in an ordinary state, per cubic foot 151lb. 11oz. Table B states that Southwell church, Nottinghamshire, (of the 10th century) is built of the magnesian limestone of Bolsover Moor, and that it is now in *perfect* condition, the mouldings and enrichments of the doorway *appearing as perfect as if just completed*, and that the choir, which is of the 12th century, and built of a stone similar to that of Mansfield (Mr. Lindley's magnesio-calciferous sandstone), is generally in good condition.

Table C, of chemical analyses, shows that the Bolsover stone is composed of silica 3·6, carbonate of lime 51·1, carbonate of magnesia 40·2, iron alumina 1·8. water and loss 3·3. Specific gravity, dry masses 2·316, particles 2·833.

All the qualities enumerated of the Bolsover stone mentioned in the report, belong to the Bolsover stone found at Woodhouse, and, like the former, the latter is remarkable for its peculiarly beautiful crystalline structure, and is, rather than otherwise, superior in its quality and appearance.

I am, Sir, your obedient servant,
Amicus.

Mansfield,
20th May, 1840.

TEACHERS OF CIVIL ENGINEERING, &c.

Sir—In the last number of your Journal, you have inserted a letter from "one who has suffered," complaining of being the *dupe* of an advertisement in the newspapers headed "Offices for Surveying, Architecture, and Civil Engineering." Now, as I sometime ago advertized with that *heading*, and as I reckon your publication too respectable to deal in *anonymous slander*, you will oblige me by publishing the name of the complainant, so as I may learn whether the charge is applied to me, and if so, set myself right in the eyes of your readers.

I am, Sir, your's respectfully,
Edward Jones,
Author of the "Principles and
Practice of Levelling."

May 11th, 1840.
24, *Charlotte Street,*
Bloomsbury.

[Mr. Jones must be aware, or ought to know, that we will not publish the names of our contributors; we consider that if there be any parties who hold out to the world that they can teach "Surveying, Architecture, and Civil Engineering," or any one branch "*in a few lessons*," they ought to be held up to the severe animadversion of the profession. This is the charge made in last month's Journal by our correspondent "one who has suffered." If Mr. Jones' advertisements do not contain such a statement, he cannot be in any way injured by the letter, but ought to be ready to support us in exposing such a practice, which exposure can only benefit, and not injure, the respectable practitioner.—Editor.]

ENCROACHMENTS OF THE SEA.

Sir—The encroachments of the sea on the coast of England having aroused public attention, a little local information may be not only interesting but useful. I have always regretted having neglected to inform you, in my former letter on this subject, that the village and church of Warden, in the Isle of Sheppy, are now covered by the sea; that since I came here in June last, a great part of Warden Point has slipped into the sea, and great part of the island, from Warden to Minster, is monthly going the same way, from underground springs and want of drainage.

In the old History of Hampshire it mentions that the people daily forded or waded across with their cattle from the Forest to "Vectis" to graze; now first rate men-of-war can sail over this place. The destruction of the western side of the island is much hastened, in consequence of the removal of stones and gravel for building and road-making.

Your obedient servant,
C. F. Parkinson, Capt. 73rd Reg.

Sheerness Garrison,
May 14, 1840.

ON REBUILDING OLD CHURCHES.

Sir—I beg to make a few remarks on the impolicy, as well as the bad taste of the Ecclesiastical Commission for Building Churches, in throwing every obstacle in the way of repairing and *restoring* old churches to their former beauty and embellishment, preferring pulling them down and building in their room, a wretched little brick building, not inaptly compared, some years since, by a celebrated demagogue and enemy to the reformed religion, to a dog-kennel tied to a sentry-box. Is it doing honour to, or paying proper respect to the cause they advocate, to consider any building, however insignificant, good enough to celebrate the worship of God in? How different the feeling in the olden time! Are we not indebted to the devotion and zeal of our forefathers for the noble architectural remains of sacred edifices, whose lofty proportions, grandeur and sublimity fill the mind with awe and solemnity?—even the Heathens honoured their Gods in stately temples. A House of Parliament, a National Gallery, a Mercantile Exchange, are justly thought worthy of a noble edifice. Is it not an insult to our God, and does it not bring religion into disrespect and disrepute, when those who ought to support, and who *themselves* live in *palaces*, consider a *hovel* good enough for their *Almighty Father*?

Scrutator.

RAILWAY COMMUNICATION BETWEEN LONDON AND DUBLIN.

The Committee appointed by the Lords of the Treasury, in pursuance of an address to the Queen from the House of Commons last sessions, "that her Majesty will be pleased to give directions that an engineer or engineers may be appointed to inquire and report upon the relative merits, and the preference which ought to be given to the respective already surveyed and projected railways following:—namely, from Holyhead, *viâ* Bangor and Chester; Portdynllaen, *viâ* Caernarvon, Bangor, and Chester; Portdynllaen, *viâ* Barmouth, Bala, and Shrewsbury; Orme's Head, *viâ* Chester:" and also, "that her Majesty will be pleased to give directions that proper persons may be appointed to inquire and report upon the best means of communication by sea between Dublin and London, as connected with the said intended railways."

The Committee have selected the line recommended by Mr. George Stephenson, from Holyhead, *viâ* Bangor and Chester; it commences at the termini of the Chester and Crewe and the Chester and Birkenhead Railways at Chester, and proceeds by Bangor over the Menai Bridge to Holyhead. The line is 85 miles long, and has only 1,504 yards of tunnel; the gradients appear to be very favourable, viz.

	Miles.	Chains.
Level	41	8
5 feet per mile and under	8	0
Above 5 feet and up to 10 feet . . .	7	20
Above 10 feet and up to 15 feet . . .	20	64
16 feet per mile	7	0
19 feet per mile	0	68
	85	0

That part of the report which relates to the crossing of the Menai Bridge, we have selected and given in full.

Passage of the Menai Bridge.—The passage of the Menai Bridge is the next point of importance. It has been supposed that this would have presented an insuperable obstacle to the lines of Messrs. Stephenson and Giles; but neither of these gentlemen propose to cross the bridge with locomotive engines, the former suggesting that the railway carriages may be drawn over by horses, and the latter by a stationary engine.

There seems to be no objection to either of these plans, and the loss of time consequent upon them would probably not exceed one-quarter of an hour.

The following observations will show the sufficiency of the Menai Bridge to sustain the weight of any number of railway carriages that may be required to pass over it.

In the first place, as far as regards the mode of passage, no important difficulty can be foreseen; the only question, therefore, is one of strength.

The weight of a railway passenger-carriage, with its load, is commonly estimated at about five tons, and the length occupied by each carriage, from one connecting pin to another, may be taken at 22 feet, when several carriages are in connexion. This would give a pressure of only ·23 of a ton per lineal foot on the length of the bridge, supposing the platform to be wholly filled with such carriages.

Let us now see what weight the bridge is capable of sustaining.

It appears from the statement of Mr. Provis, who was the resident engineer during the erection of this splendid structure, that the suspended part between the pier consists

		Tons.	cwt.
Of 16 main chains, including connecting plates, screws, bolts, &c., ...	weighing	394	5
Of transverse ties..................................	——	3	16½
And of suspended rods, platform, &c.	——	245	13½
The total weight being		643	15

The distance between the points of suspension is 579 feet 10½ inches, and the deflection 43 feet. With these data, the tension in terms of the weight may be readily computed, from the properties of the catenary curve; but it will, perhaps, be more satisfactory to derive it from the actual experiments of Mr. Rhodes, who superintended the erection of the chains, and who found, practically, the tension to amount to 1·7 times the weight. This makes the tension on the supporting chains from the weight of the structure alone to amount to 1,094 tons.

Now to sustain this tension, we have a sectional area in the 16 chains of 260 square inches, which, according to Mr. Barlow's experiments, made on the chain-cable testing machine at Woolwich, are capable of sustaining 2,600 tons, without injury to the elastic force of the iron, namely, 10 tons per square inch, the ultimate strength being 25 tons per square inch.

If, then, from the absolute strength of the chains............	2,600 tons.
We deduct the strain due to the weight of the bridge	1,094
There remains a surplus of strength of........................	1,506 tons.

which is competent, therefore, to sustain a uniform load (allowing the tension to be 1·7 times the weight) of $\frac{1506}{1\cdot7}$ or 886 tons. Now if the bridge were covered with loaded railway carriages on both sides, it would only be equivalent to 265 tons, leaving still a surplus strength of 621 tons. The objections, therefore, that have been raised respecting the capability of the bridge to bear the weight of the railway carriages which it might be required to support must be considered as utterly groundless.

Mr. Stephenson proposes to establish a station at each end of the bridge, where the locomotive engines would be kept in readiness to be attached to the trains.

DESIGNS FOR THE NEW ASSIZE COURTS, LIVERPOOL.

[We have received several communications respecting the decision of the Committee, and our attention has also been drawn to a letter which appeared in the Liverpool "Albion"; it contains a general description of the successful design of Mr. Elmes, and some very appropriate remarks; we therefore give the article entire, with which we hope our correspondents will be satisfied, instead of publishing their papers, as we are so pre-occupied with matter, that we can ill spare the space for any additional remarks; however, we shall be glad to receive any other communication on the subject that may throw some light on the proceedings, in order that we may be able to make some comments on the conduct of the Committee in the next month's Journal, if found necessary.]

Sir—A plan has been pretty generally adopted, of late years, in respect of obtaining designs for public edifices. I mean that of advertising for competition drawings, and awarding one or more prizes, in the ratio of their excellence or fitness, with the implied certainty, that the bearer of the first prize should have still more substantial reward, in the superintendency of the erection of the future edifice. This, in itself, would appear, and perhaps is, the best method that, under the circumstances, could be adopted. It might be difficult to point out a better; but, Sir, a little reflection will at once show, that, however excellent this may be, in the abstract, it entirely loses that character unless it be invariably coupled with the necessary qualifications for judging, combined with excellent taste, in the *awarders* of the honours.

I have held this opinion, in common with others who have given the matter consideration, since the plan became general; but, whatever confirmation it might have then required, the award in the proposed Assize Courts has now amply confirmed. When I say, that the sub-committee, in this case, had not the necessary qualifications to fit them for deciding, let it not be understood, that this is done through any feeling of disappointment or personal hostility to gentlemen with some of whom I am on terms of intimacy: on the contrary, I trust I shall be able to prove the position with which I set out to the satisfaction of your readers; but I may, at once, say, that I am not an architect, the truth of which is *known to you*, therefore have not competed for the prize, consequently am not a "disappointed man" individually; but, perhaps, as one of the public, this feeling is particularly strong, and more especially so when I look aronnd the walls of the Exhibition-room, in Postoffice-place. I am not only disappointed, Sir, with the prize-drawings there to be seen, but, with one or two exceptions, the whole. They evidence want of invention, in the first place, and want of judgment, in the second; and the two designs that combine these essentials, have, for want of judgment in the committee, been thrust aside. The majority of the designs, prizes included, evince a servile imitation of the Greek style of temple architecture, which, every day's experience teaches us, is neither fitted to our wants nor our climate. If the Greeks had had either the one or the other, they would have invented a style to have suited both; but invention with us is at once crushed, the ambitious aspirant is unceremoniously thrust out of the arena of competition, and all for want of the necessary qualifications in the awarders of patronage.

In proof of this, I shall, at once, draw your attention to the plans to which the first prize has been awarded, those of Mr. Elmes. By a narrow inspection of these, it will appear very evident the Committee were incompetent to the task allotted them.

In Mr. Elmes' perspective drawing we have a very pretty picture, exquisitely drawn, showing the Railway terminus, on the one hand, and the Assize Courts, on the other, with St. George's-hall occupying a prominent feature in the centre. With this picture, it is very obvious, the Committee have been misled. It is a most successful deception. Now for the proof. The height of St. George's-hall is about eighty-five feet. The fall of the ground, in the direction of the Courts, is twenty-seven feet. The height of the Courts at the lowest end is seventy-six feet. There should, therefore, be shown, in *the drawings*, a difference of thirty-six feet in their relative heights; but, as the Courts do not come quite to the extremity of the fall, say thirty-two feet. This difference, however, is most dexterously evaded, and leaves us to imagine the Courts and St. George's-hall will be, to a spectator in the foreground, very nearly of one height. Bnt this is not all. In this height of seventy-six feet is included a dead wall, rising fifteen feet above the parapet of the colonnade. This wall is so much set *back* from the front that it could not be seen except at a considerable distance from the building. This, in effect, would rob it of fifteen feet more, which, added to the thirty-two feet above, gives us forty-seven feet, or, in other words, taking as much height from it, within three feet, as goes to a five-story warehouse. Let it be understood, this is in relation to St. George's-hall; but, in relation to itself, this dead wall would, practically, reduce the height of the building to sixty-two feet, making the visual difference between the Courts and St. George's-hall about fifty feet.

The perspective drawing, however, does not, in the slightest degree, convey this difference; but, in execution, this would be necessarily exhibited. Another example. The stylobate, at the southwest corner, is shown only six feet six inches high, whereas the *real* height is about thirteen feet. Moreover, windows are shown in the plans, which are omitted in the elevation; but, had they been shown, they would have spoiled the effect of the picture.

More examples of this nature might be adduced, but let us come to the interior arrangements, for, after all, these are, by far, the most important parts to be taken into consideration; but, it is very evident, Mr. Elmes calculated on the incompetency of the Committee to measure his perspective drawing and compare it with his plans. The event shows he was right. This gentleman, in the document attached to his plans, asserts, that he has complied with the printed instructions, and that every apartment contains the full number of square yards required by them. His designs, however, show he has exceeded the limits by thirty-six feet in the length of the building, but this is concealed in the plan, and is only to be detected by carefully examining the section. His Courts fall considerably short of the areas required, which were 290 square yards for the Crown Court, and 320 for the Civil Court; but the space given by Mr. Elmes is 231 yards for the former and 264½ yards for the latter, making a deficiency of 59 square yards for the one and 55½ for the other, making a total deficiency of 114 square yards out of 610; but there are two lobbies at the end of the Courts, situated behind some columns, which, if he mean to include, would leave a deficiency of 74½ square yards. From this, it is very clear, the prize was not awarded Mr. Elmes for strict adherence to instructions, although he deliberately says he has done so.

Let us now take a glance at the arrangements for the transaction of the business of the Courts. The counsel have to ascend 30 feet to their robing-rooms, and then to descend 26 feet into court in their wigs and gowns. The jury of the Crown Court have allotted them a small room, 15 feet by 10 feet, and for the Civil Court, one, 17 feet 6 inches by 9 feet 6 inches, neither of them possessing a water-closet: this last omission, no doubt, is intentional, —nothing on earth like it to bring obstinate men to a prompt decision.

The clerk of the indictments'-room is situated 30 feet *above* the ground floor. The witnesses have to ascend that height from their room, which is on the basement floor, and then to descend to the grand jury-room, situate midway, and, ultimately, to the ground floor into court. The most casual observer must, at once, perceive this to be the worst possible arrangement. The floor of the judge's bench is 6 feet 6 inches above the floor of the court, which is just twice the height it should be. The semicircular form of the courts is objectionable, from the irregular reverberation of sound proceeding from a curved surface. This has been so fully proved in other buildings similarly constructed, that various expedients have been adopted to abate the evil.

Another most important point, the lighting of the interior apartments, is really bad. He has resorted to the most clumsy and awkward expedients, and all to render darkness visible. The judges enter a vestibule totally dark; and the attorneys, barristers, &c. could not recognise one another in the corridors allotted to them. In short, the general interior arrangements are exceedingly ill contrived, being so disconnected by having four different storeys, beside the one containing the gaol arrangements, while in no case ought it to have exceeded two.

Now, Sir, for a word or two on the architectural composition of the exterior. My opinion is, that, in execution, it would prove a complete failure, and disappoint those who have been *caught* by the pictorial effect of the drawings.

The east, or principal, façade is badly arranged. The portico, contrary to the rules of architecture, and I may add a still greater authority, good taste, is denuded of the most essential element of grandeur and beauty; I mean a noble flight of steps ascending to it: instead of which it is placed on a mural stylobate, having an insignificant door stuck in its centre, as if by accident, or as if the architect had originally forgotten to provide his principal entrance.

The colonnade on either side the portico ought to have been full and uninterrupted in its whole extent: instead of which, it is divided into three parts, with pilastered blocks of masonry, each eighteen feet wide. This, in execution, would totally destroy that simple unity which ought to characterize that style of architecture the artist himself has chosen. This defect does not strike the observer in the picture, in consequence of the admirable *management* of the lights; but, in the actual structure, this would be most unsightly and offensive to good taste. Not satisfied with this violation, he has placed a line of dead wall, fifteen feet high, above the broken line of columns beneath, which, in effect, would appear to crush it, when seen from a distance. This ungraceful method of acquiring height has, I have observed, invariably destroyed the effect of other buildings where it has been resorted to. I could point out a much greater number of defects; but, at best, it is a most ungracious task: however, it is better to do so now than allow the building to be quietly erected with all its faults, and then cavil when it is too late to apply the remedy. Upon the whole, I consider the decision of the Committee to be altogether an erroneous one, because, if we put the architectural beauty out of the question, the interior arrangements will require to be entirely remodelled to adapt them to the purposes for which they are intended.

It would take too much time to point out what arrangements really should have been made; but here are a few omissions.

Mr. Elmes has no magistrates'-room, nor a room for the high-sheriff; he has also omitted the court-keepers' apartments and has not shown *cells for prisoners;* he has no room for attorneys consulting apart with a prisoner, neither has he any room where a prisoner can see his friends on obtaining a judge's order. The room he has appropriated for counsel is only twenty-six feet by seventeen feet six inches, and this is to accommodate upwards of 200 barristers, and this number, with the increasing business of the courts, is sure to be greater. In fact, the room in the present courts devoted to this purpose is much larger.

It might be asked, if so much is abridged and omitted, what has become of the space, seeing that the plans exceed the given amount? I answer, it is absorbed in large galleries, to accommodate the public attending the Crown Court. This is plausible, no doubt; but what is the practical result? That the morbid taste of that portion of the community who delight in accounts of murder, rape, and robbery will be amply gratified; while the other portion of the public attending the Civil Court have but small accommodation. Experience has sufficiently shown us, that the disgusting details of criminal courts act more by way of *precept* than example on the auditory who frequent them.

In fact, throughout the interior arrangements there is an utter absence of that knowledge of the business of courts which is indispensible to their proper arrangement. Apartments that, according to the practice of law courts, should be together are placed on different storeys, occasionally on opposite sides of the building; hence would accrue a continual travelling up and down stairs, and traversing long dark passages, when, with proper arrangement, all these annoyances might have been avoided.

I think, after this, you must agree with me, Sir, that the Committee have been misled by the beauty of Mr. Elmes's drawings, which, after all, do himself, or the artist he employed, great credit.

Seeing, through the medium of your paper, that a memorial was presented, on this subject, to Council, by two of our resident architects, Messrs. Cunningham and Holme, I have been, in consequence, induced to give their designs a more miuute examination.

Their second design, I mean the one with the towers, having a magnificent portico, with a flight of steps leading up to it. This building would have been a real ornament to the town. It combines many desiderata for the promotion of architectural effect; but the towers alone are worthy of Martin. Had they been executed, they would have formed a most prominent architectural feature in the eye of strangers visiting us. I have not studied their design with a view to minute criticism. Had they received the first prize, it is highly probable they would not have been let off so easily: however, there is, at once, boldness and novelty in the conception of their plans, which bias me very much in their favour. As to the interior arrangements proposed by these gentlemen, they are very much superior to Mr. Elmes's. They seem to have forgotten nothing, but have rendered the edifice, as a whole, entirely subservient to the purpose of the courts. Yet, if I recollect aright, these gentlemen's designs were, at once, placed *hors de combat*.

In their memorial they complained that their plans had been set aside, on the alleged ground of having exceeded the limits pointed out in the instructions; while, on the other hand, the plans to which the prize *was awarded* had, in a similar manner, also very much departed from them. Notwithstanding which, they were not only allowed to retain their place among the final ten, but actually carried off the prize! Now, Sir, I cannot help thinking they had just right of complaint. But how was it met by the Committee, in the person of the Town Surveyor? At first is was denied, and *then* admitted, that is, "*if* the *porticos* were meant to be *included*"! This last, Sir, is the crowning joke of the whole. Hamlet, with the *principal* character omitted, is a fool to it. "If the porticos were meant to be included in measurement"! Only think. Suppose your office is in want of a devil, you advertise for one, his mother applies, (if devils have mothers,) you want to know his height. The lady replies, "Four feet six." You object to this as being too small, when you are met with the *after thought*, that that is his height as far as his shoulders only; but, then, he is a *head* taller still, if you mean to include that most unimportant portion of his corpus. Of such a nature was our surveyor's answer to Messrs. Cunningham and Holme's objection. The porticos being, I need scarcely say, "the very heads and fronts" of the building.

In conclusion, Sir, I may add, that my only motive, in this letter, is, my duty as a burgess, and a love of having my visual organs gratified by beautiful architectural objects, in my walks through our flourishing good old town.

I am, an old correspondent,

ONE OF THE PEOPLE.

Liverpool, May 14th.

EXTRACTS FROM THE LOG OF THE ARCHIMEDES.

First Day, April 21.—Light breezes from Northward. A.M. 7·30, left Dover Roads with H.M.S. Ariel for Calais. Archimedes rather leading. At 8·45 both vessels made sail, with light wind from S.W. At 10, Ariel one mile astern, and sail shortened. 10·23, abreast of Calais—beating Ariel by six minutes.

Second Day, April 22.—A.M. 4·10, left Calais with the Ariel—wind W.S.W. and fresher than on the preceding day; Ariel rather gaining, but on sail being set on both vessels, Archimedes came in first by five minutes. Close hauled the whole distance, and rate with sail and steam 9¾. Time of arrival in Dover Roads, 6·42 A.M. A.M. 8·30, the same morning, left Dover Roads with H.M. Packet Beaver—light winds from S.W. 9·20, one length a-head of Beaver. 9·45, three lengths a-head of Beaver—rate 9½ knots—engine making 27 strokes per minute—barometer 26 inches. 10·45, 2½ cables length a-head of Beaver. 11·30, Beaver made sail. Noon—light breezes from S.W. Beaver two-thirds of a mile astern. At 4·53 P.M. arrived in Ostend Roads, beating Beaver by four minutes.

Third Day, April 23.—Topmasts struck, and gaffs down, wind W.—A.M. 9. Followed in Beaver's wake through the Channel. At 10, going 9¼ knots—Beaver a-head one-third of a mile. 11·30, abreast of Dunkirk. At noon—moderate breezes from W.N.W.—Beaver one mile a-head—Strokes 26—rate 8¾ knots. P.M. 2, made sail—Beaver 1½ mile a-head—9½ knots. At 4h. 28m. 30s. Beaver a-breast of Dover Pier.—4h. 37m. 30s. Archimedes ditto.—Nine minutes in favour of Beaver.

Fourth Day, April 25.—A.M. 8·43, started a-breast of each other with H.M. Packets Beaver and Ariel—light breezes from E. by N.—rate 9½ knots—barometer 26 inches—strokes 27. Beaver arrived first in Calais Roads by 2 minutes 45 seconds—Ariel second, not quite three lengths a-head of Archimedes. 11·25, left Calais Roads in search of H.M.S. Swallow, with the Ostend mails. P.M. 1.28, abreast of Swallow. 2·52, abreast of Dover Pier, Swallow about two lengths astern—no sail set all this day.

Fifth Day April 27.—A.M. 6·40, started with the Britannia Steamer for Boulogne, she being half a mile a-head. At 7, on her beam—rate 9½ knots—Britannia made sail. At 7·15, made sail also—moderate breezes from the N.E.—course South—10 knots—27 strokes—barometer 26 inches. At 9h. 2m. 45s. rounded the buoy off Boulogne Pier. At 9h. 49m. Britannia passed the buoy. Difference of time 21m. 15s.—of distance about 3¾ miles. P.M. 1·52, made sail for Dover—fresh breezes from N.E.—sailing and steaming, close hauled, 9½ knots, clear full, 10 knots. At 4, the wind being fresh and dead a-head, took in sail—steaming, 8¾ knots. At 5·19, off Dover Pier—having made the passage, under the above circumstances, and *against an ebb tide*, in 3h. 27m.

Sixth Day, April 28.—On this day, Capt. Chappell, R.N., and Mr. Lloyd, Engineer from H. M. Dock Yard at Woolwich, commenced the superintendence of the trials, having been sent down specially by the Lords Commissioners of the Admiralty to report thereon. A.M. 8·45, left Dover Roads with H.M.S. Widgeon—moderate breezes, wind E. by N.—rate 8½ knots—for Dungeness light, distance 19 nautical miles. Widgeon first by 5m. 30s. In returning, against a head wind—rate, 8 and 7¾—strokes, 26 per minute. Widgeon beat by exactly 10 minutes. No sail set this day. Widgeon is the fastest of the Dover packets, her engines being of 90 horse power; her power is thus 10 horses greater than the Archimedes, while her tonnage is 80 tons less. Most of the Dover packets are of 70 horse power; they are, on an average, about 90 tons smaller, draw 4½ feet less water, and are not so broad by 5 feet. During the whole of these trials the sea has been perfectly smooth, and no opportunity has hitherto occurred of displaying the peculiar advantage of the Screw over the Paddle Wheels in a rough sea and a strong wind. Since the above was written—in a run to Calais, in a dead calm, Widgeon beat Archimedes by only 3½ minutes in going, and 4 minutes in returning:—Time in going over, 2h. 9m; returning, 2h. 11m.

The French Government Steamer, La Poste, was beaten on this occasion 25 minutes. She is about 135 tons, and her engines of 50 horse power.

On the 1st of May, the Widgeon and Archimedes started together for Calais, with a moderate breeze, both carrying sail and steaming.—Archimedes performed the distance to Calais Roads in 2h. 1m., beating Widgeon by 9 minutes. In returning to Dover, she beat the Widgeon by 5 minutes, making the distance in 1h. 53m., the fastest passage EVER made between France and England by 14 minutes.

[To render these experiments complete, the quantity of fuel consumed in each trip and by each vessel should be ascertained.—EDITOR.]

NEW ROYAL EXCHANGE.

THE Gresham Committee met on the 7th ult., to decide on the two plans for the Royal Exchange submitted to the Committee by Mr. Cockerell, R.A., and Mr. Tite, President of the Architectural Society, and after a protracted discussion, the Committee finally determined in favour of Mr. Tite by 13 votes to 7. The building will now be proceeded with without delay. The following description of the design appeared in the daily papers:—

The design thus adopted possesses features of a very striking character, and is much approved of in the city. It will be recollected that the site of the intended building is of an irregular form. The ground westward of this site is to be cleared by the removal of the two masses of building which now stand in front of the Bank, so as to leave an uninterrupted area from the intersection of the streets in front of the Mansion-house; in this area it is intended to place the statue of the Duke of Wellington. From the nature of the ground, any form of building which should adequately occupy it, must be much wider at the east end than at the west. This irregularity is concealed, and, though not rectangular, the proposed structure is perfectly regular in the plan.

At the west end, the architect has placed a very striking portico of eight columns of the Corinthian order. The width of this portico is 90 feet, and its height to the apex of the pediment 75 feet; this is 16 feet wider and 17 feet higher than the portico of the church of St. Martin-in-the-Fields. Behind the portico is the central entrance to the Exchange, which is deeply recessed within a large arched opening, having on each side an arch of corresponding general character. When clear of the portico, the building is increased in width by pilasters and recesses, making its greatest extent at the west end 106 feet.

The south front, or that towards Cornhill, is an unbroken line of 250 feet, occupied by a range of Corinthian pilasters, the intervals between which are divided in height into two stories. The lower of these consists of a series of rusticated arches, which comprises the shops, and the entrances both to the Exchange and the offices; the upper story includes a uniform line of decorated windows for the principal floor.

The north front is generally similar to the south.

The east front is terminated at its northern and southern extremities by curved corners, each containing three rusticated arches, with windows above; and from the centre of this front rises a tower 160 feet in height, terminated by a vane, formed of the ancient grasshopper, the crest of Sir T. Gresham.

The total length of the building, including the projection of the portico, is 293 feet, and its extreme width at the east end is 175 feet.

The area for the merchants is nearly in the centre of the edifice. It is a parallelogram, 170 feet in length from east to west, by 112 feet from north to south, and is entered in the centre of each of the four side. There is a colonnade of the Doric order round this area, which leaves about one-third of the whole space open. Over the colonnade is a second order of attached Ionic columns, with arched and highly decorated windows in each intercolumniation.

With reference to the arrangements of the plan, it appears that the ground floor is principally appropriated to shops and offices, except a part of the north-east corner, which is given to Lloyd's, and the south-west, which is reserved for the Royal Exchange Assurance-office. On the one pair, or principal floor, the Subscribers'-room, Commercial-room, Reading-room, and other apartments of Lloyd's, occupy the whole of the eastern portion of the building, and about two-thirds of the northern. The Gresham Lecture-rooms, library, and other apartments, fill up the rest of the north front and part of the west. The south front, in nearly all its length, is given to the corporation of the London Assurance, which establishment is to be accommodated in the new building; and the remainder of the south and west is appropriated to the Royal Exchange Assurance.

THE METROPOLITAN WATER SUPPLY.

TABLE shewing the foreign matters contained in one gallon of *Thames water*, taken from different parts of the river, and of the same quantity of the water from the *Valley of the Colne*.—(See Minutes of Evidence, 1840, p. 19.)

Thames water.	Carbonate of lime.	Sulphate of lime and common salt.	Total in 1 gallon.
	Grains.	Grains.	Grains.
From near Brentford	16	3·4	19·4
From near Hammersmith	16·9	1·7	18·6
From near Chelsea	16·5	2·9	19·4
Sources of the proposed London and Westminster Water Company.			
From Otterspool (main spring)	18·8	2·5	21·3
From main stream (Valley of the Colne)	19·3	2·5	21·8
From the river Colne	18·1	3·2	21·3

Besides the above, the Thames water, as well as that from the Valley of the Colne, was found to contain a very minute portion of oxide of iron, silica, magnesia, and carbonaceous matter.

[We were not prepared to find that the water from the Otterspool spring, flowing through chalk, contained such a minute quantity of carbonate of lime as 2 grains in 70,000 grains, (the weight of a gallon of water), more than water of the river Thames. To us this appears to be a very satisfactory result in favour of the proposed new Company.—EDITOR.]

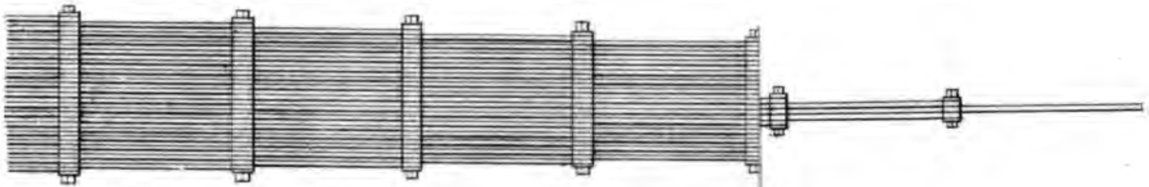
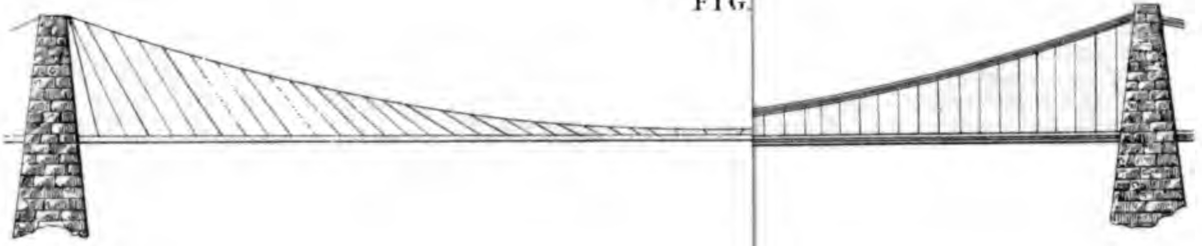


FIG.



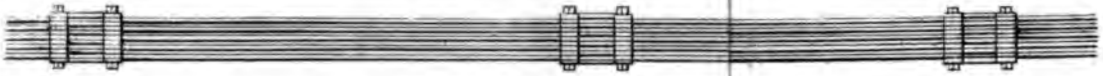


FIG. 9.

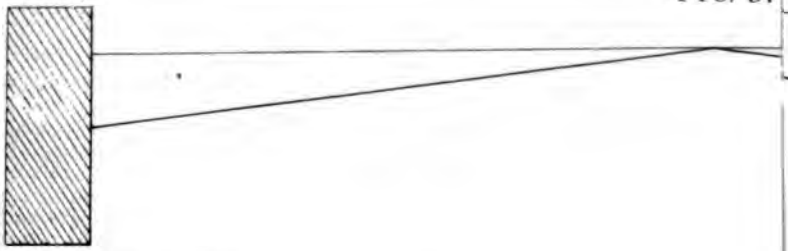
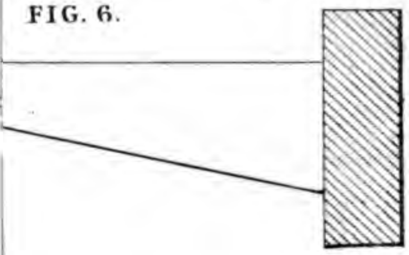
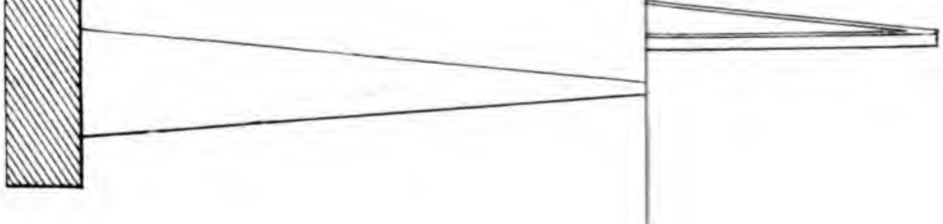


FIG. 6.





SUSPENSION BRIDGES.

WITH AN ENGRAVING, PLATE X.

Lord Western's Letter to Lord Melbourne, descriptive of a Suspension Bridge built across the Avon, at Bath, by Mr. DREDGE, *a resident of that city, upon an entirely novel principle.*

MY DEAR LORD,—Having heard that Government is about to expend a further sum of money on the reparation of the Menai Bridge, which is said to be in a perilous state, I cannot refrain from entreating your attention to the vast improvement that has been made in the construction of suspension bridges by Mr. Dredge, of Bath. During a recent residence of two months in that city, I have had an opportunity of seeing often the bridge that has been built by him across the Avon; it is a beautiful structure, and at once commands admiration of its beauty and confidence, in its stability; I have communicated with him frequently about it, and altogether the consequence has been so strong an impression upon my mind of the vast and immeasurable superiority of the principle on which it is built over anything that has hitherto been attempted, that I have been led into this somewhat extraordinary intrusion upon your Lordship on a matter with which I may be, I own, justly considered to have no very intimate or scientific acquaintance; such however is the simplicity of the work, that I will not hesitate to attempt some account and explanation of it, in the hope of drawing your attention in the first instance, which, if I accomplish, you will be led, I think, to give it a closer examination, which will produce eventually as strong a conviction in its favour on your mind as it has produced upon mine.

Mr. Dredge's statements of the superiority of the power of his system over the established plan of structure certainly at first astonished me; he has indeed proved by trials, in the presence of very many persons, a superiority of strength to the extent of at least 150 per cent. These were made upon small models of bridges formed severally on the present and on his new principles, each out of the same quantity of iron, but he carries his calculations of the accumulating power derivable from size and extent over and above the 150 per cent. shown upon the small models to such a degree, that I will not venture to state it; but if he should be called upon, in the way I trust sooner or later he will be, to exhibit his system before your Lordship and the public, he is confident he can mathematically and practically establish any of the statements he may make, and I have little doubt he will be found to be correct. He insists on the possibility of reconstructing the iron work of the Menai-bridge at a less sum than the superfluous iron would sell for, so much less is requisite than was there used, and he pledges himself to the power of the bridge, if the irons are altogether altered and reconstructed on his principle to be capable of supporting on transit 1,000 tons. The Menai-bridge is believed to have cost near 150,000*l*., and to have consumed in its construction above 2,000 tons of iron, and to be declared only capable of sustaining 733 tons on transit. Before I submit to your Lordship a detail of some practical experiments Mr. Dredge has made justificatory of the declarations he thus ventures to put forth, I will endeavour to give some explanation, imperfect though I am sensible it must be, of the fundamental principle upon which his mighty fabric is erected; I must give it merely as it has struck my unlearned common sense, and which it has, from its simplicity, with a force so irresistible that it makes me believe I fully understand it; in aid of my endeavour I have given a few drawings on an annexed sheet. I conceive the grand foundation may be said to be the rendering the chains strongest and indeed very much the strongest at the base, tapering them by regular degrees to the centre, where they come at last, in fact, to a cipher, from the cipher commence therefore their size, weight, and strength, which regularly increase by degrees quite up to its base, which base you know in a suspension bridge is the towers of masonry on which the chains are hung; in truth, it is the application of that principle horizontally which is so obviously necessary in all perpendicular erections, of superior size and strength at the base, and tapering away to a cipher on its ultimate summit; as for example the obelisk, the pyramid, the church spire, and which principle he shows to be as effective horizontally applied as it is in the perpendicular; indeed, it may be said to be far more effective, as it has to support in so difficult a position, comparatively with the perpendicular, its own intrinsic weight, and a heavy transit load besides. The manner in which the chains of his bridge are formed to render them stronger at the base is shown in plate, Fig. 2; and Fig. 4 is a section of one of the main chain of the Menai-bridge; these are the same size throughout, creating thereby an enormous intrinsic and superfluous weight, exceeding that which it has to sustain on transit, and this it is which constitutes the grand vice of the present system, and which sooner or later Mr. Dredge's must supersede. Mr. Dredge's bridge may be well imagined by supposing a church spire laid horizontally, and met by another of equal dimensions at the point, as represented at Fig. 8.

There is another figure by which the principle may be more clearly shown; it is the bracket; two brackets meeting at their extreme points give a very satisfactory idea of it, as in plate, Fig. 9. Every body knows that the bracket tapering from its base will bear horizontally a great weight, but if it was the same size from the base to its extremity, though it might continue to be called a bracket, it would hardly sustain itself if it was any considerable length.[*] I have to remark now upon another most important peculiarity in Mr. Dredge's bridge, and that is the diagonal direction of the road suspending rods, instead of perpendicular, and forming, therefore, as it unquestionably does, a powerful contributary effect to the support of the whole, and this is also most easily capable of direct practical proof. There is still a further point of difference and advantage in Mr. Dredge's bridge, which appears to me to be equally simple and as proveable, and which also essentially contributes to increase its aggregate power and security—that is, its horizontal action or pressure, which is also made obvious by a simple and familiar figure representing one half of a bridge: suppose a straight rod of any given length, fasten a cord at one end of it, and thence to the top of a wall, place the other end to that at which the cord or chain is fastened against the wall, at such a distance below the top of the wall as will render the position of the rod horizontal, and it must be plainly seen that the rod is supported as well by its compression against the wall at one end, as by its cord of suspension at the other, see Fig. 10. Thus every component part of the structure is brought harmoniously to work and in perfect unity of action towards the grand object. I will now advert again to the Menai-bridge, and show further in essential points the difference between that and indeed most other suspension bridges, and Mr. Dredge's. The actual intrinsic strain at the centre of the Menai-bridge according to "*Drewry*," page 167, amounts to 1,878 tons, and at each extremity 1,943 tons. This vast intrinsic weight operates its own destruction, increasing its self-destructive power as it increases in length; thus it becomes vibratory, and upon a gale of wind blowing upon its broadside, it has a swing or pendulous motion; this I have felt myself in passing it, the wind blowing strong at the time.

On the other hand, as I have observed before, upon Mr. Dredge's principle, the strain and weight only commence at the centre, increasing as the strength of the bridge increases up to the base, and of course its ability to sustain it; this difference between these two systems may be readily imagined. By supposing a ton of iron formed into a bar of equal dimensions from one end to the other, as is shown in Fig. 7, and fixed into a wall, it will hardly support itself, still less any additional load; if extended to any considerable length it will not support itself; on the other hand, make the same weight of iron into a taper form, as in Fig. 6, and it will support its own weight to any extent, and a heavy extrinsic weight in addition; but further than this, if the parallel equal-sized bar is cut away by one-half, (see dotted line in Fig. 7,) it will then support itself and an extrinsic weight in addition. The reason is obvious; it has discharged itself of that which was altogether superfluous and therefore noxious in the extreme, being wholly destructive of power to carry any extrinsic weight. In this figure is a singularly accurate exemplification of the vice of the Menai-bridge, and others built upon the same principle, and the obvious good sense of Mr. Dredge's. Thus his genius has led him, by the simplicity and perspicuity of his conceptions, to effect a discovery which, I firmly believe, will turn out of great national importance, the recognition of which by the country will, I am sure, be felt by him as the highest possible reward. Having thus endeavoured to show the simple principle on which Mr. Dredge's system is founded, I proceed to give you some account of some experiments he has made practically substantiating the truth of it, prefacing them, however, with a brief description of the expense and particulars of the Victoria bridge across the Avon, built in 1836, and which has proved itself equal to its inventor's most sanguine expectations; its cost was 1,650*l*., its span is 150 feet, and only 21 tons of iron were consumed in its construction, which, at 20*l*. per ton, is only 420*l*.; the great expense, therefore, was on the masonry and the timbers supporting the platof wire, their spans were 4 ft. 6 in., their deflections 6 inches, and their platforms were 2 feet. The parallel chain model (old system) broke down on putting six sacks of beans on its platform, weighing about 13 cwt.; the taper chain model (new system) bore the six sacks of beans, seven sacks of malt, weighing 10 cwt., 2 cwt. of iron, and 11 men at the same time, all of which did not break it down. In Bristol, Jan. 6, 1838, before Messrs. Protheroe, Guppy, and others, two other models of equal materials and dimensions were tried. The parallel chain model bore 1,565 lb.; the taper model bore 3,681 lb. Again, in Bristol, January 10, 1838, more trials were made before Messrs. Acraman, Daniels, Hillhouse, and many others of the first merchants of Bristol, Dr. Waldron, and many others of Bath, with models of equal material; the parallel chains bore 1,456 lb.; the taper chains bore 3,696 lb. Another trial before the same party on the same day was made with models constructed by Mr. Cross, of Bristol, unknown to Mr. Dredge, in order to prove that all was fair in the former trials; the result was, the parallel chains bore 2,632 lb., and the taper chains bore 6,849 lb. Each model broke on adding more weight, and the wire throughout on the taper principle was reduced one size by the experiments.

---

[*] It may be remarked that there is not a strict similarity between the common bracket and the bridge, inasmuch as the platform or horizontal line is, in the former, above and in the latter, below; there is, however, no real difference. The power of the bracket is compounded of suspension and compression, that is, suspension from the fulcrum, and compression against the fulcrum. In the case of the common bracket, the horizontal line which is uppermost, being fixed or fastened securely to the fulcrum, performs the suspenson part of the work, the arch or diagonal line below the compression, attaching itself to the fulcrum without fastening; the case of the bridge is, however, only so far different, that the arched line does the suspension part, and the horizontal the compression.

Now, my Lord, all I request is, in the event of further repairs or improvements being about to be undertaken of the Menai bridge, that you will allow Mr. Dredge to exhibit some similar experiments before your lordship or the Treasury, or before the Bridge Commissioners, and in the presence of any of the most eminent engineers you may choose to summon. Finally, my lord, Mr. Dredge declares that such is his thorough conviction of the truth of his theory, and its facility of execution, that he would gladly undertake, at his own expense and risk, *the whole of the iron work*, if he should be allowed to reconstruct it, which he believes he could do, the bridge standing all the time, and that it should be competent to sustain 1000 tons on transit; the superfluous iron of the present bridge he is pretty confident would pay him, and give a balance in favour of Government.

Questions may, after all, fairly be put to me to learn why, with all these advantages of Mr. Dredge's system, exhibited with so much apparent fairness, has not his principle been at once generally acted upon? Why has he not been called upon in many cases to execute what he thus promises? Why, if he can build the proposed Clifton bridge, as he says he could, for one-third or less than Mr. Brunel's estimate, is he not called upon to do so? One good reason is obvious—a prudent caution on the part of the public disinclines them to overthrow long-established systems, and to oppose or even question the judgment of long known and respected authorities; this feeling operates very naturally and happily in philosophy as well as in politics; but it should not in either be carried to the extent of checking the progress of improvement by well-considered means; too great a tenacity for old systems may exist in the minds of many persons, though their motives may be good and their minds not illiberal; Mr. Dredge's principle of suspension bridge building completely overthrows the theory and practice of a Telford, a Brunel, whose experience and talents we are bound highly to respect, and to whose genius I readily offer the humble tribute of my admiration; can we then be surprised that the public should evince some fear, and some reluctance, hastily to adopt Mr. Dredge's novel principle or theory, in substitution of that which has been so long acted upon? They ought, therefore to pause, they ought to inquire if there are any persons about to direct the construction of other suspension bridges; it is a duty they owe to those for whom they may be acting, to examine fully into the merits of a novel system which *promises fairly* such advantages, before they determine to persist in the further adoption of the present, of the correctness of which the state of the Menai bridge, and the vast expenditure it occasions, may well create a doubt, independent of the obviously faulty principles on which it is, I think, clearly shown to be constructed. No human being was ever exempt from error, and Messrs. Telford, Brunel, and others, must not be considered to be infallible. I have only to add, my dear lord, that in making this address to you, I have no other motive than the desire of assisting to bring forward genius, and secure for the country the benefit of a most valuable discovery and work of art, which appears to me, for want of form or road, which are still of insufficient dimensions and strength, but which, of course, are quite unconnected with the principle on which the bridge is built; the chains are under 10 tons, and are equal to sustain 500 tons on transit. In November he began putting the chains of this bridge together, and in the following month it was opened for general use; its road is stoned like common roads. In further proof of the correctness of this system, tests have been made before various parties at various times, viz., at Bath, January 2, 1838, before Messrs. Worsams from London, Ball of Cambridge, and others of Bath, with models whose lengths, deflections, and weight were equal, the chains of each model between the fulcrums were only 9 oz.

that encouragement which I think it merits, to be in danger, like very many others, of being lost sight of altogether.

I have the honour to be, my dear lord,
Your faithful and obedient servant,
To the Viscount Melbourne. WESTERN.

P.S. Your lordship will of course understand that I entertain no idea of expecting or asking anything more of your lordship, than a reference of Mr. Dredge to the proper departments, with a recommendation to give his plan of improvement due attention and consideration, should Government be under the necessity of engaging in further expense upon the Menai bridge.

[At the Adelaide Gallery on the 19th ultimo, Mr. Dredge explained the principles of his patent suspension chain bridge, and performed some experiments in the presence of several gentlemen to show the relative merit of his suspension chain in comparison with one on the ordinary construction. He had made two models of suspension bridges, each 5 feet 8½ inches long, and with chains of 8½ inches deflection—the first experiment was with a model constructed with two chains on the ordinary principle, each consisting of 3 wires laid parallel to each other as in fig 4, to which by the aid of vertical wires as in fig. 5, a platform of wood was suspended, this platform was loaded with 7 full grown persons, and upon the eighth getting on, it broke down. The wire chains were fractured at the point of suspension. The weight of the wire in this model was 6½ ounces. The next experiment was with two wire chains consisting of six wires at the point of suspension, and diminishing off to one in the centre similar to fig. 2, these chains supported by suspension wires placed obliquely as shown in figs. 1 and 3, the platform which was loaded with 11 persons, without producing any fracture, until one or two of the party stamped on the platform, when it broke down, the fracture taking place at the junction of the oblique wires with the chain of suspension. The weight of the wire in this model was only 6 ounces.—EDITOR.]

REFERENCE TO THE ENGRAVING, PLATE X.

Fig. 1, a view of Victoria bridge, constructed by Mr. Dredge on hi patent principle over the river Avon, at Bristol.

Fig. 2, a chain constructed on Mr. Dredge's principle.

Fig. 3, a bridge of large span similar to the Menai, constructed on Mr. Dredge's principle.

Fig. 4, one of the main chains of the Menai bridge.

Fig. 5, a view of the centre suspension of Menia bridge.

Fig. 6 to 10, diagrams to illustrate the principle of Mr. Dredge's chain.

EXHIBITIONS OF COMPETITION DRAWINGS.

SIR—In my former letter it did not occur to me to make a suggestion that might possibly be deemed worth consideration, which is, that in exhibitions of competition drawings—supposing they do not take place until after the decision has been made, there should be no disclosure as to which among them have obtained premiums, at least not until a given time has elapsed. The advantages that would attend such a regulation are, I conceive, tolerably obvious, because, not knowing which are the rejected and which the approved designs, the public would then give their attention to all, at any rate to such as appeared to them of most mark and likelihood, without prepossession or bias, whereas, when it is known which are the premiumed drawings, those naturally engross attention, and the rest are looked upon, by the majority of visitors at least, as the doomed, consequently not entitled to admiration. Public opinion would thus be left free from prejudice, prepossession, and prejudgment; consequently there would be a stimulus to diligent examination and scrutiny which does not now exist.

How far such a plan would prove a convenient one for the judges themselves, is a different matter. Probably it would subject them to a severe ordeal, and place them in an awkward situation; for it is my opinion that had not the fact been made known beforehand, no one would ever have suspected that Mr. Railton's and Mr. Grellier's designs obtained the first premium, the one for the Nelson Monument, the other for the Royal Exchange.

However, so far from being made any objection to the course here recommended, that becomes an additional argument in favour of it, because those with whom the power of awarding the premiums rest, would feel a much greater degree of responsibility than they now do, and would accordingly exercise greater caution and scrupulousness, lest they should find themselves in a most disagreeable minority. Those who would not care to submit their judgment to such hazardous ordeal, are but ill qualified for the important office they assume.

I remain, &c.,
Q.

MOVING BEACHES.

"I acknowledge no authority but that of observation."—*Linn.*

THE attention of scientific and practical men has for many years been directed to the action of the sea, and tides which give motion to the shingle, and other matter composing the beaches of our island, and this important affair has been a subject of much speculative opinion, but it appears not hitherto to have received that systematic investigation which is essential. Indeed the contrariety of opinion so often expressed on this subject, seems to indicate an absence of a satisfactory mode of inquiry to obtain a practical and safe deduction.

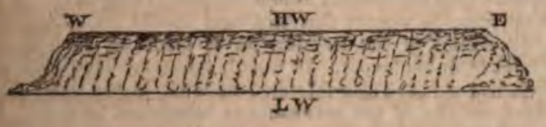
The coast of Kent and Sussex seems to have attracted attention to the subject of the commonly called *travelling beach*, under an erroneous presumption that such occurrences are peculiar to those shores, but experience, the result of practical observation, demonstrates that where nature is placed under similar circumstances, as to her formation, and the operations of the wind, sea, and tides, there she is immutable in her results, and therefore in all parts of the globe, the movement of the beach is the same as is observed on the Dover, or Channel shores; but in *no instance throughout the world has a beach been found to travel along the line from one point to another of a shore or coast.*

We proceed then to prove the egregious error so commonly adopted as to the *travelling* of a beach—divesting our statement of all terms that do not belong to, or which are not generally understood by nautical and other persons that take an interest in this affair.

The flood in the British channel sets in from the westward, and runs with considerable velocity in many parts to the eastward; it is during the time of this flood, with winds blowing from particular points of the compass, that *accumulation* of beach occurs.

The margin of all coasts throughout our globe having *beach forming the line of high and low water mark*, is constantly moving, so as to alter the angle considerably between the two lines. The wave falling on and moving the beach (for there is no movement of the bed of the ocean where the sea does not *break*), takes it up, and deposits it between the high and low water mark, in extraordinary tides and winds, and high seas, simultaneously, and with mathematical accuracy, along a line of beach to the extent of many miles, the largest pebble or shingle, and the greatest quantity, forming the same into a ridge or bank, in a line parallel to the high water mark (Fig. 1.); from the *commencement* of the shingle west, *to its terminus east.* A beach of sand is operated on precisely in the same way, but if the beach travelled in a right line with the coast, from west to east, than would the line of high water beach be on an inclined plane from west to east, and in time a mountain would be formed at the eastern terminus of the *beach.* (Fig.2.)

Fig. 1.



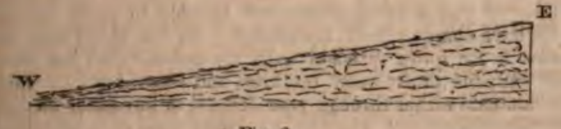
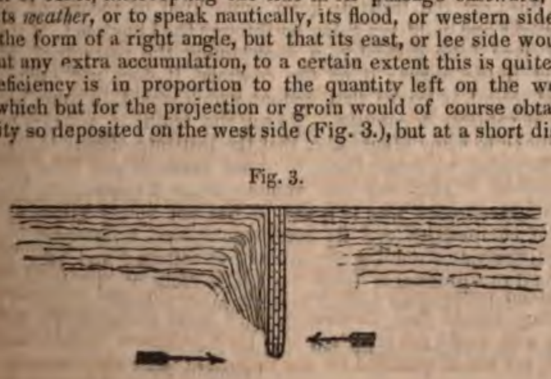


Fig. 2.

It is correctly stated that a groin or any natural projection beyond the line of coast, intercepting the tide in its passage eastward, would have its *weather*, or to speak nautically, its flood, or western side filled up in the form of a right angle, but that its east, or lee side would be without any extra accumulation, to a certain extent this is quite true; this deficiency is in proportion to the quantity left on the weather side, which but for the projection or groin would of course obtain the quantity so deposited on the west side (Fig. 3.), but at a short distance east of the groin, or on its lee side, the beach assumes its natural form, and the line continues till it meets with another similar interception. So then the only object obtained is an additional accumulation westward, less its amount eastward of the groin, and let it be remembered that this eastern continuation goes on, although the accumulation on the western side of the groin has not filled it up, to its seaward end, and therefore does not pass round it. Beachy Head, Dungeness, the south and north Foreland are all natural groins, but the Bays east of the Head to leeward, the eastern side of Dungeness, the east Bay of Dover, Deal beach, (the *highest of all* modern accumulation, notwithstanding the projection of the south Foreland as A GROIN,) Margate, Herne Bay, &c., all simultaneously accumulate, despite of those extended projections.

Fig. 3.



The fact of the angular formation of the accumulation at the groin, at once proves the direction the beach takes when thrown up by the sea. As the sea, at all *times* during the prevalence of the accumulating tide and wind, falls on the shore at an angle of 45°, so what it lifts up, it throws on in the same direction, but if the beach moved in a right line with the coast, it would fall on, and form at the groin in a like line.

The next practical fact we adduce to disprove the hypothesis of a travelling beach is, that wherever a line of shingle beach is intercepted by chalk, rock, sand, or any other material, of which such part of the coast may be composed, there no pebble or shingle exists. On the rocky shore west of Dover, in which there are many interstices, receptacles for various shell fish, there is no shingle or pebble found in any part of those rocks; if the beach at Dover, &c., came from the westward, it must pass over those rocks, and consequently in its transit some would be deposited in the holes of the rock—but it is not so.

Captain Martin of Ramsgate, in his recently published book on that harbour, states, that the beach north of Deal advances eastward at the rate of one mile in 60 years. A map of this part of the coast published 60 years ago, is before us, and *Stone End,* (meaning the end of the *shingle beach,* and the commencement of a sand and muddy shore,) is marked thereon, and although 60 years have passed away since the mark was made, *Beach End remains in statu quo.* About 90 years have expired since the commencement of Ramsgate harbour, and therefore according to this gentleman's statement, the beach in the vicinity of Sandwich Haven, during this elapsed time, has advanced towards the mouth of Ramsgate harbour, and in time would block it up, first having placed itself before the entrance of Sandwich harbour.

In a Report of the Commissioners of Ramsgate harbour, made in 1755, they stated "*that from the east there is a drift of large shingle.*" It would be well if recent assertions were sustained by proofs.

Our next fact in this controversy is, that the pebbles composing beaches differ much in quality, colour and size. Those at Dungeness, differ from those at Dover, &c., and therefore the latter cannot be supplied from the former.

Having said what we think is sufficient to expose the error, in the supposition that beach travels from one point to another, let us proceed to show the real extent of *moving beach;* we have already said that the sea takes it up, and lodges it on the shore at an angle of 45°, (the angle at which the wave falls when it does not roll in perpendicular to the shore); this inclination of the wave is aided by the flood tide, which gives the beach so lifted up, an easterly direction on the Kentish coast, inclining with the flood as it does on all other shores. On a change of wind, and with an ebb tide, the accumulating power ceases, and is succeeded by the drawback, or scattering power, and the beach recedes to its former lodgment, going off in the opposite angle or direction—and there it remains till the accumulating power again removes it. This is the extent of a *moving* beach.

A shingle beach is not carried by the drawback wave so far seaward as is a sand beach; the gravity of the latter being more than that of the former, it is drawn often 50 yards beyond the low water mark, and there forms a bank, called by pilots, and beachmen the outer bank, over which it is with much difficulty and danger passed by boats. This is as we have said like the shingle brought up by the accumulating wind and tide, and lodged between high and low water mark, simultaneously along an entire line of coast. The shingle beach at Offordness, (formed similar to Dungeness), along the coast of Norfolk, and Suffolk, round the British Isle, and throughout the world is operated on in a like manner, so that the opinion of travelling or moving beach being peculiar to any particular coast is erroneous. Nature is, we repeat, immutable in her results, acted upon by similar causes throughout the world.

It has been asked how do you account for the increase of beach? Observation has induced us to be of an opinion that there is a progressive principle of accretion in the pebble or shingle. Quite small fine beach is sometimes in great quantities found near the low water mark, and appears to be the nucleus of the larger stone or pebble.

We come now to a question of much importance, and intimately connected with our subject, viz., what is the cause that one convex wave rolling with impetuosity on the shore, and receding back with the like rapidity, leaves behind it a quantity of beach, so that at the end of the flood tide, as the water falls away during the ebb, a large extra accumulation of beach is found up towards the high water mark? But with a change of wind the same formed billow falling on the shore, and receding back to the ocean with the like velocity as the former, takes away with it the beach to a considerable depth, and scours away whatever is within its drawback influence. We ask for a solution of this problem, if buckets of water are thrown on a floor, each produce, as they rush up an inclined plane and fall back again like effects, taking away whatever sand or loose matter is reached by the water—not so with the impinging and receding billows—one has an accumulating, the other a scattering power.*

The subject of moving beach is, indeed, as your intelligent correspondent Nota,† remarks, *connected* with the construction of piers, and into which, as another of your correspondents observes, celebrated engineers have searched in vain, and therefore the lack of correct information on this point is one cause of the failure in improving existing, or in establishing eligible refuge harbours.

Nota has also made some judicious remarks on the subject of the accumulation of mud on the northern shore of the Severn. Whether his hypothesis be correct or not, as to the cause of this, I will not now dispute, but similar operations are in action in all bays and rivers. The deposit on the shores of the Thames is similar every flood tide, that the watermen are obliged during the receding tide, by artificial means to cause an undulation of the water, so that in its drawback course it may take away the deposit of the preceding flood, and keep the shore clean.

Your correspondent speaks of a ship's rudder having been found 10 feet below the level of the shore, while excavating the Bute Dock, Here we have another proof of the progressive accumulation on the margin of the coasts. In the bed of the river Store, in the Island of Sheppy, and in many other parts, the relics of vessels and boats, and also of anchors have been found. Instances have occurred of stranded vessels having been buried between the high and low water mark for many years, and by the effect of the drawback wave have again been uncovered.

Much valuable land has been redeemed from the river Humber by a deposit of mud, a large portion of the rich marsh soil in the vicinity of rivers is an alluvial deposition, and a great part of Holland is the result of this principle in nature, aided by artficial means.

The great geologist Baron Cuvier stated that which we by observation discover to be the fact, viz., that all bays have a disposition to fill up, the water passing along a coast with velocity is charged with matter in suspension, this water or tide falls on the shore inertly, and deposits the mud or that with which it may be charged, so that there is a progressive action proceeding onward, which in time forms the bay into a straight line, and this is often accelerated by the washing down of each point of the crescent which forms the bay. I with deference to your correspondent, we are of opinion that he has confined his exposition of this matter to a local cause, rather then to a general principle.

There is, we humbly submit, a prevalent error in the remarks of your correspondent, who follows Nota, and it is one of those errors which it is most difficult to grapple with, it pervades the minds of pilots, beachmen, &c., viz., the deducing a coincidence from a coexistence, it is of the character of the old tale in endeavouring to connect Tinterton Church with the Goodwin Sand. I do not apply this to him, many of his deductions are correct, but I am sceptical as to the fall of Chalk Cliff west of Dover, being the cause of the diminution of the bar or beach at Dover harbour, if he had watched the effect of the late prevalent winds, he would have seen that this diminishing power was at work many miles east and west of him, from the *North Foreland to the Isle of Wight*, &c., and on the northern and eastern shores; so that he appears to form his opinion "from partial, and not from general laws."

This gentleman asks for a solution of the problem, *i. e.* "the cause of the regular high marks successively following each other on Lydd Beach?" (as it does over other parts of Dungeness), we answer, the same cause that has produced similar effects on other coasts—here again we revert to general laws. It is admitted that each ridge indicates a former high water mark, and that the present high water mark is considerably seaward of those ridges, the inference necessarily is that either the tide does not flow so high as it formerly did, or tha the beach has been raised by some *unusual* flow of the tide, the latter is the solution, and we observe like effects on other shores, &c. Deal Beach from a distance, southward of Walmer, and north of Sandown Castle, including the site on which *Beach Street* at Deal is built, is the largest accumulation of beach we know of, caused by one of those tides we have spoken of, since which no such rise of the tide has occurred, but if we pass further inland in this locality, we find ridges of shingle similar to those at Dungeness. The same effects have been produced on the coasts of Norfolk, and Suffolk, traced out by the like existing proofs.

The site on which stands the town of Great Yarmouth, gives a demonstrative proof of the accuracy of our deductions, it was once a sand in the ocean, called by the Romans, Cerdic sand.

It is a very natural consequence that matter thrown on the shore by an extraordinary rise of the waters of the ocean, should increase its level above the latter, inasmuch as the annually decomposed vegetable matter, (its own produce), &c., tends to cause such an effect. Buildings constructed thereon have after many years been again taken away by the raging wave.

We have only to remark on the subject of the sea advancing most prejudicial on one part of the coast, taking away fields of corn, &c., and receding from another part, that we see similar effects in various parts of the world, and have an opinion on the cause of this, but it might be deemed problematical for the present, therefore we withhold it.

In conclusion, we remark that our globe is progressively under transitions, and while these are going on, we detect the change of substance, but not the principle of destruction.

> "See dying vegetables life sustain,
> See life decaying vegetates again."

Having lengthened this letter much beyond our intention, we conclude, earnestly and with deference to the opinion of others, by inviting investigtion on the important subject here discussed, and to give it their serious and candid attention, and let it not be forgotten that subjects susceptible of mathematical demonstration are within the solution of educated engineers, but those relating to the change of form of coasts, to the impinging of the wave, effect of currents and tides, and the disemboguing waters are understood only by practical observation, the result of much attention, and long and extensive experience on various coasts.

HENRY BARRETT.

May 11, 1840.

CATHOLIC CHAPELS—MR. PUGIN—THE INSTITUTE.

SIR—In the Argus newspaper of May 10th, it is stated that "one architect alone, Mr. Pugin, is at present engaged in the erection of no less (fewer) than seventeen Catholic chapels in England." If such be really the case, no wonder that Mr Pugin should be so impressed with the excellence of the Romish, for it seems to have operated almost a miracle in his favour. It would, however, have been more satisfactory, had we been also informed at what places those chapels are, whereas, not one of the seventeen is mentioned by name. Perhaps some of your correspondents will be able to point out such of them as have come to their knowledge. As for Mr. Pugin himself, he seems to be quite satisfied with the notoriety he has earned for himself with his professional brethren, and accordingly does not care to communicate either through your Journal or any other medium, the slightest intelligence of what he has lately done or is actually doing. There never is a single architectural drawing of any kind by him in the exhibitions of the Royal Academy, consequently, if he sends any there at all, they are invariably among the rejected.

Pray, does not the Institute keep some kind of record of all the public works and buildings going on through the kingdom? If it does, you will have little difficulty in ascertaining the correctness of the statement in the Argus; if, on the contrary, it does not keep such historical record, it leaves that undone which would, in time, become a series of valuable documents. To say the truth, it appears to me, and I believe to many others also, that the Institute stands in need of a little filipping to rouse them to some exertion *pro bono publico*. How happens it that only one volume of its Transactions has yet made its appearance? why is it that it has not boldly taken up the subject of competition and its notorious abuses, undeterred by the various difficulties attending any attempt at reform? and why has it not rescued the profession from the Black Hole at the Royal Academy, by establishing an annual architectural exhibition upon a proper and becoming footing? These are questions which, I dare say, you cannot answer personally, but can any one else.

I remain, &c.,

P. S.

---

* The cause appears obvious to the writer.

† See Journal for May, 1840.

ON THE CONSTRUCTION OF OBLIQUE ARCHES.

SIR—In your number for April, p. 116, I observe some observations upon my work on Oblique Bridges, made by an anonymous writer under the signature B. H. B., to which I feel disposed to make a reply, requesting the favour of a place for it in your valuable periodical.

In the first place I wish to premise that I think no author is under the necessity of replying to the criticisms of an anonymous writer, and that it would be more courteous if the writer of a paper professing to be of a scientific character were to put it forth with his name.

B. H. B. in alluding to myself says as follows: "he observes the lines of the courses of the intrados should be made perpendicular to a line drawn between the extremities of the face of the arch, without ever giving any reason for it, or making any remark on the subject farther than that it should be so."

It is quite true that I did not assign a reason for this construction; because it is obviously in order that all the courses may be as nearly as possible at right angles to both faces of the arch, and at the same time parallel to each other. The greatest variation from the rectangular intersection is at the middle of the development, or at the crown of the arch: and at this point where the course is nearly horizontal the variation is of no practical importance or objection: and it may be shewn that it differs from a right angle by an angle whose tangent $=$ $\left(1-\frac{c}{a}\right)\cot\theta$.

The two methods suggested, proposed, or recommended by B. H. B. to be substituted for the above, are most extraordinary. His second method which he prefers, may be described as a recommendation to build an oblique bridge by *commencing with horizontal courses*, and "summering" them (in workman's phraseology) as the work rises upon the centre. In this way the unscientific ugly old canal bridges were built half a century back. B. H. B. concludes his short dissertation on his proposed improvement in the following words:

"The advantages to be derived from this are, first, that this angle being less than that commonly employed, there will be less tendency to slip; and secondly, that being more nearly perpendicular to the face of the arch, there is consequently more stability."

Every thing herein contained is merely assumed; and most certainly I venture to say that the stability of the oblique arch does not depend upon the courses being laid at right angles to the line *bounding the development*: it is scarcely possible to conceive any thing more rotten than such a construction would prove.

B. H. B. next says, "I am astonished at the serious errors into which Mr. Buck has fallen in his last chapter, which is devoted to *further investigation*, but which had better have been omitted altogether. In attempting to determine at what altitute above the level of the axis of the cylinder the thrust of the arch will be perpendicular to the bed of the voussoir, he gives a formula which produces the strange result that the smaller the arch-stone, the lower will be the said altitude, that is to say, the more secure will be the arch, and also that it will be able to be built at a more acute angle. Another still more strange phenomenon, the result of this formula, is that the greater the skew of the bridge, the less of the arch will have to be supported by iron dowels and bolts: thus an arch built at an angle of 25° will require no assistance from dowels, an arch built at 55° will require to be secured by dowels to a height of 25° above the springing." I will carry the quotation no further, because I shall now proceed to show that "these errors" are attributable to B. H. B. and not to the formula. For the information of those who have not read the work referred to, I will here supply the general formula which I gave for the value of $\sin\tau$, as follows:

$$\text{Sin}\,\tau = \sqrt{\left\{\left(1-\frac{r+e}{r}\cos^2\theta\right)+\left(\frac{a}{2c}\sin^2\theta\right)^2\right\}}-\frac{a}{2c}\sin^2\theta$$

In this expression θ is the angle of obliquity, r is the radius of the cylinder, c is the thickness of the arch, and τ is the angle of elevation of the point sought above the axis of the cylinder.

Now if B. H. B. will look attentively at this expression, he will see that its meaning is precisely the reverse of that which he has stated; for instance, "the smaller the arch stone" (or e is taken) the greater will be the value of $\sin\tau$; and this is because e appears only in the *negative* part of the expression. Again, the *greater* the value of e or the thickness of the arch stone, the greater will be the negative part of the expression, and consequently the *smaller* the value of $\sin\tau$: and the lower the point sought at which the thrust of the arch is parallel to its face. And consistently with this, "the greater the skew of the bridge," the greater is the value of $\cos^2\theta$ which is also found only in the *negative* part of the expression, and consequently the smaller will be the value of $\sin\tau$, and "the less of the arch will have to be supported by iron dowels and bolts." This result of the formula is said to be a "strange phenomenon." I have no doubt it is very startling to the reader, as I know it to be to every practical man at first sight, but it is nevertheless true as I have satisfactorily determined experimentally. I have constructed a model of a portion of an arch at an angle of 25°, which is semicircular on the direct section: this arch stands and keeps its form well without dowels, (although it is but a narrow strip), whereas one made to the same scale at an angle of 45° will not stand at all.

B. H. B. proceeds to say, "the whole of these errors arise from having given the expression $\frac{\text{cosec}\,\theta\cos\tau}{\frac{1}{2}\pi}$ (nearly at the bottom of page 37) instead of $\frac{\cot\theta\cos\tau}{\frac{1}{2}\pi}\div\text{cosine}\,(\theta+\phi)$ where ϕ is such an angle that its tangent $=\frac{\cot\theta\sin\tau}{\frac{1}{2}\pi}$. This must be evident to any one who considers that the courses alter their angle with regard to the face of the arch, which Mr. Buck has not taken into consideration."

Here I most readily admit that I had omitted to take into consideration the variable angle at which the courses intersect the face of the arch. I discovered this defect about two months after the publication of the work, and immediately prepared a correction for it, which is as follows. I retain my former notation and the expression for the altitude of the point C′ from which B. H. B. says the error arises, namely $\frac{\text{cosec}\,\theta\,\cos\tau}{\frac{1}{2}\pi}$, but in this case I shall substitute its equivalent for the segmental formula, or, $\frac{c}{a}$ cosec $\theta\cos\tau$, because the equation thence derived is general. I shall now refer to the annexed diagrams: those numbered 28 and 29 are identical with those to be found in my work; that numbered 27 is somewhat different.

Fig. 29.

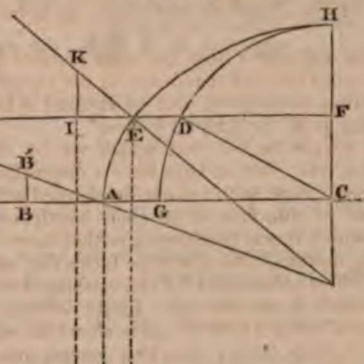
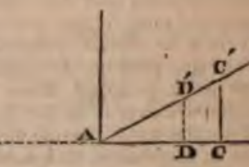


Fig. 28.



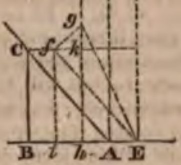


Fig. 27.

Let A B C in the annexed diagram, called fig. 27, represent the plan of the acute quoin of the arch, then when the point A may have ascended to the altitude signified by τ, let us suppose it to be perpendicularly over the point E, fig. 27. Let us also suppose A C fig. 27 which is sec θ, and CC′ fig. 28, which $=\frac{c}{a}$ cosec θ to remain constant, then C′ which is the summit of the tangent CC′, fig. 28, will not be perpendicularly over the point *f*, fig. 27, (the extremity of E *f* drawn parallel to A C), but it will be at *g*; here *f g* is the projection in plan of the tangent C C′; now draw *g h* perpendicular to the face of the arch B A, and to fulfil the conditions *g h* must be a horizontal line, and the distance E *h*, considered as radius, if multiplied by the tangent of I E K, fig. 29, must be equal to the altitude of *g* above E, fig. 27, or to $\frac{c}{a}$ cosec $\theta\cos\tau$. It now becomes necessary to determine an expression for the distance E *h*, and first E *i* is equal to A B by construction, therefore E *h* = E *i* − *i h*, or (1 − *i h*.)

$$fg = \mathrm{CC'} \times \sin\tau = \frac{c}{a}\operatorname{cosec}\theta\sin\tau,$$

$$\text{and } \frac{c}{a}\operatorname{cosec}\theta\sin\tau \times \sin\theta = \frac{c}{a}\sin\tau = fk = ih$$

$$\therefore \mathrm{E}h = (1 - \frac{c}{a}\sin\tau)$$

$$\tan \mathrm{IEK} = \frac{\frac{c}{a}.\frac{r+e}{r}\cot^2\theta + \sin\tau}{\operatorname{cosec}\theta\cos\tau}$$

$$\therefore (1 - \frac{c}{a}\sin\tau)\left(\frac{\frac{c}{a}.\frac{r+e}{r}\cot^2\theta + \sin\tau}{\operatorname{cosec}\theta\cos\tau}\right) = \text{the altitude}$$

of the tangent at h above E.

Equating these we have

$$(1 - \frac{c}{a}\sin\tau)\left(\frac{\frac{c}{a}\frac{r+e}{r}\cot^2\theta + \sin\tau}{\operatorname{cosec}\theta\cos\tau}\right) = \frac{c}{a}\operatorname{cosec}\theta\cos\tau$$

Whence we obtain

$$\sin\tau = \pm\sqrt{\left\{\left(\sec^2\theta - \frac{r+e}{r}\right) + \left(\frac{a}{2c}\tan^2\theta - \frac{c}{2a}.\frac{r+e}{r}\right)^2\right\}} - \left(\frac{a}{2c}\tan^2\theta - \frac{c}{2a}.\frac{r+e}{r}\right) \qquad \text{(A)}$$

The values of τ for the several cases of obliquity given in my "Essay" are here computed by the formula now given, and for the sake of comparison, the former values are also inserted, as follows:

	By formula now given.	As before given.
When $\theta = 65°$	then $\tau = 38° \; 55'$	$27° \; 17'$
55	„ $\tau = 38 \; 6$	25 13
45	„ $\tau = 36 \; 35$	21 47
35	„ $\tau = 17 \; 50$	15 38
25 40′	„ $\tau = 0 \; 0$	0 0

If the ratio $\frac{r+e}{r}$ were omitted as suggested by B. H. B., the expression would become

$$\sin\tau = \pm\sqrt{\left\{\tan^2\theta + \left(\frac{a}{2c}\tan^2\theta - \frac{c}{2a}\right)^2\right\}} - \left(\frac{a}{2c}\tan^2\theta - \frac{c}{2a}\right) \qquad \text{(B)}$$

Now in this equation whatever may be the value of θ, the value of τ remains the same, and when the arc is a semicircle

$$\sin\tau = \frac{c}{a} = \frac{2}{3{\cdot}1416} = {\cdot}63661 = \sin 39° \; 32' \; 24''.$$

This result is in accordance with the speculations of B. H. B., but it is entirely at variance with practice and with correct theory, and so will any formula into which an expression for the thickness of the arch does not enter. The formula A now given contains it, and will be found correct. By this formula $\sin\tau$ continually approximates to, but never reaches $\frac{2}{\pi}$, and vanishes when $\theta =$ either 25° 40′ or 90° as it ought to do.

B. H. B. says, "in finding a term for CO, I would reject the thickness of the cylinder, and consider the point O as that to which the tangents of the small curves, which show in the face of the arch tend: this is more correct, because the joints of the voussoirs being segments of curves there can be no point on the face of the arch at which a ball would roll down the bed in a line exactly parallel to the face; this may be considered too minute for observation, but besides being more correct it will simplify the question much."

Here, I beg to observe B. H. B. is again wrong, and for this reason; these curves of the joints in the face of the arch are all in a vertical plane, and if the thickness of the arch be rejected, they must be regarded as *lines merely*, and a ball would consequently roll down any one of them, or down the chord of any one of them.

My investigation proceeds upon the supposition that the chord of the small curve forms one side of a triangle, the tangent of the intradusal spiral another side, and a line at right angles to the face of the arch, the third side: this triangle must be supposed to exist in the thickness of the arch, and to be parallel to a tangent plane at the point sought, and therefore this is one amongst many reasons why the thickness of the arch should not be rejected, even if it were attended with the advantage stated by B. H. B., namely, that "it will simplify the question much." But instead of simplifying, B. H. B. has produced an equation without explaining how it is obtained, and which he has not been able to reduce to a form for direct solution.

He infers from his equation, "that in all arches of a moderate skew, the point τ is about 40° above the level of the axis of the cylinder;" but I have herein shown that when the thickness is omitted, the point is independent of θ, and always 39° 32′ 24″ above the axis.

Now, although B. H. B., with much complacency, has informed your readers that my last chapter "*had better have been omitted altogether*," I remain of a different opinion. That chapter commenced as follows. "It will naturally be asked to what extent of obliquity is it safe or practicable to construct an arch on the principles herein given? This question we will attempt a solution of, or at least to throw some light upon it." How far I have succeeded it is for others to decide. I am well aware that the subject is not exhausted, inasmuch as I have pursued it further since the publication of the essay, but I have herein confined my remarks to the matter contained in B. H. B.'s communication.

It may be proper to observe, that in all this investigation friction is not taken into account; but friction is an important element in bridge: building, indeed, no arched bridge of masonry would stand without it-if, then, an expression for friction were to enter into the equation, the value of $\sin\tau$ would be very much diminished. And for this reason, my first equation, as given in the "Essay," though not strictly accurate, is practically better than the amended one now given.

Let B. H. B. take up the subject involving friction in his conditions, and he may have an opportunity of rendering considerable service to the engineering profession.

Your obedient servant,

Manchester, May, 1840. GEO. W. BUCK.

ON LIMESTONE IN IRELAND.

An Account of the White Limestone which lies along the Coast of the County of Antrim, in Ireland. By WILLIAM BALD, F.R.S.E., M.R.I.A., &c., June 1837.

WHAT is the white limestone on the Antrim coast?

It is of the same geological composition and formation as the chalk strata in England; but it possesses a characteristic difference in being of much greater induration than in general the English chalk strata; the dynamic unit of the force of crushing, and fracturing it by weight may be taken as equivalent to nearly that under which the Scotch Craigleith sandstone moulders into ruin.

The white limestone lies under the basaltic rock, and in contact with it, it is generally allowed to differ from the chalk of the south of England only in its being of superior induration; the white limestone assimilates to it in the nature and arrangement of the flints, and organic remains which it contains. The flints as mentioned in a former paper, are dark and grey, some of them of a reddish tint. The large nodules of flint are sometimes from eight to twenty inches long. Organic remains occur in the flints; belemnites of the real kind are common, and generally petrified by spar of a calcareous nature and sometimes ammonites.

The white limestone rests on the mulatto, a rock consisting of grains of sand, with specks of green earth. This mulatto rock corresponds with the green sandstone found under the chalk strata in England; it also contains fossil remains.

Under the mulatto rock lies a bluish limestone containing much clay; this rock is analogous to the lias limestone of England, it abounds in animal remains.

Under the lias or blue limestone are beds of marl containing much clay, and in which are beds of gypsum or sulphate of lime (alabaster), and the rock underneath consists of sandstone of a reddish colour.

I have now traced the comparison between the strata connected with the white limestone in Ireland, and the chalk strata in England, so as to leave no doubt whatsoever of their entire and perfect identity with each other. Besides, my friend Dr. Smith, the father of English geology, whom I have known for more than twenty-two years, and who has been in the north of Ireland, and is acquainted with the Antrim limestone, agrees in the description which I have here given of it; further Dr. Smith informed me that the Antrim white limestone was rock of the same formation as Flamborough Head, in England.[*]

---

[*] "*Carbonate of Lime.*—Almost all the varieties of marble and common limestone, together with those earthy concretions that take place in many natural springs and caverns, as also the numerous class of substances called

As to the hardness or induration of the white limestone; I gave a kind of dynamic unit of the labour or ordinary force employed in boring into it for the purposes of blasting, viz., that the force of two men striking with hammers were able to sink into the white limestone at the rate of one foot in depth in half an hour, (jampers 1⅝ of an inch in diameter, hammers about three pounds weight) then the elements employed were the momentum of the hammers, united to the power of the arm, and the time; this is the common labour or force employed. It may be asked what is the amount of it? But to answer this is rather difficult, because one element cannot be perhaps exactly determined, which is the force of the arm united to the momentum of the hammer; but the induration of any rock may be reached or measured in a more exact form; in boring with heavy iron cylinders, and merely working with the simple element of the descending force of the gravitating mass of the iron bar; and the amount of this force may be estimated by the number and length of the descending strokes, using the following formula. The momentum of a body falling is the mass or weight multiplied by the square root of the height it has fallen through and by 8·021.

The number and length of the strokes, and the time occupied would be the measure of the force employed in sinking to any depth in any kind of rock, and this indeed might be used as a standard of comparison to measure the amount of the manual labour employed in boring through all the varieties of rock.

Sir John Robison, the ingenious secretary of the Royal Society of Edinburgh, observes with great truth that much depends on the shape and condition of the cutting point of the bar employed in boring, and also on the goodness of the steel and iron. In operations of this kind approximate results can only be obtained, and these should never be determined, regarding any particular rock, without numerous experiments on all the varieties it would present.

The hardness or induration of rock, as well as its strength to resist crushing by weight are matters of high importance to the engineer; but has any scale yet appeared to measure the amount of these two properties?

The weight which rock can sustain without crushing or fracture, may I think be taken as the amount of its strength. And the measure of its induration or hardness to resist perforation may be determined by the momentum of the descending strokes of an iron bar, and the time employed. The law of the relation of strength compared to hardness may be then traced from these results in all the various kind of rock strata.

What are the causes of the disentegration of the white limestone? *i. e.* the chemical agents which act so powerfully in decomposing its structure? To what cause does it owe its great hardness? If it be ascribed to heat from its close vicinity to the trachyte formations, the lava of the more ancient revolutions, and which I admit is a natural inference; but then on the other hand, I ask to what cause can be ascribed the high induration of the secondary limestone which covers so extensively the plains of Ireland, so far removed from any kind of volcanic remains or formations?

Indeed since the discovery of the carbonic acid gas contained in limestone by the illustrious Dr. Black, the science of chemistry has achieved but little practically in unfolding the chemical properties which give induration to the various strata of the older series, and among which are to be seen the most beautiful, as well as the most imperishable material for engineering works to be found on the globe. Some of these rocks have been wrought at periods so extremely remote that there is difficulty sometimes even to fix the epoch, yet some of them carry on their surface the sharp unimpaired lines of the tool after a lapse of more than three thousand years, and this is fully proved and illustrated in glancing at the granites and sienites employed in the construction of those surprising monuments of Egyptian antiquity, which have astonished all ancient and modern travellers.

In concluding, I find that Mr. Playfair, who ranks so high in the annals of science, has alluded to the black veins which traverse the white granular marble of Carrara having a resemblance to the sutures in the human scull:—are those very remarkable fissures confined alone to the calcareous strata?

It appears that Herm granite is effectually crushed by a pressure of 6·64 tons on the superficial inch; and that a cube of it containing 64 inches weighed 6 lbs. 6 oz., consequently a cubic foot weighs 172·125 lbs., and that there is 13·013 cubic feet to the ton; then it takes 6·64 tons, or 86·41 cubic feet of its own mass to crush one superficial inch, consequently a column an inch square of Herm granite containing 86·41 cubic feet would reach to an elevation of 12,443 feet, or 2 miles and 628 yards high, or 36 times higher than St. Paul's Steeple,* before it would reach its maximum elevation of crushing by its own weight at the base.

Craigleith stone is crushed by about 3 tons weight on the superficial inch,—137½ cubic inches weighed 11 lbs. 10 oz., a cubic foot than 146·094 lbs., being 15·34 cubic feet to the ton, or 46·02 cubic feet of its own mass to crush a superficial inch. A column of Craigleith stone containing 46·02 cubic feet and one inch square would crush at its base by its own weight at the height of 6624 feet, or one mile and 448 yards, being more than 19 times the height of St. Paul's steeple.

A four sided pyramid of Herm granite whose side at the base would be one inch and containing 86·41 cubic feet, would reach an elevation of 37,329 feet, or 7 miles and 123 yards before it would be crushed by its own weight at the base, equal to 109 times the height of St. Paul's steeple.

And a four sided pyramid of Craigleith stone whose side at the base would be one inch, and containing 46·02 cubic feet, would reach an elevation of 19,872 feet, or 3 miles and 1344 yards, before it would be crushed by its own weight at the base, equal to more than 58 times the height of St. Paul's.

PUBLIC BUILDINGS IN LONDON.

A Critical Review of the Public Buildings, Statues and Ornaments in and about London and Westminster—1734.

BY RALPH.

[In consequence of this pamphlet being out of print and very scarce, we have deemed it advisable to reprint such portions as relate to those buildings that still remain undisturbed. Ever since its first appearance, it has always been read by the architect with considerable interest. It was printed anonymously, but it was well known to be by an eminent critic of the day, Ralph, the progenitor of Ralph Redivivus, whose effusions have occupied several numbers of our Journal, and created considerable interest in many of our architectural readers; but since the latter has deserted us, we hope only for a short period, we shall occupy occasionally our pages with some extracts from the above work.]

As nothing contributes more to the grandeur and magnificence of a city, than noble and elegant buildings, so nothing produces a heavier censure on a nation's taste than those which are otherwise; it is for this reason highly laudable to stir up the public to an attention, to such elegant and proper decorations as these, not only in regard to the fame of the people in general, but their interest too. One of the chief reasons why Italy is so generally visited by all foreigners of genius and distinction, is owing to the magnificence of their structures, and their number and variety; they are a continual bait to invite their neighbours to lay out their money amongst them, and one may reasonably assert, that the sums which have been expended for the bare sight of those elegant piles, have more than paid the original charge of their building. This Louis XIV. was sufficiently apprized of when he undertook Versailles, and the company that single fabric only has drawn into France, has made that crown ample amends for the expence of erecting it; and they have both the use and reputation of it still into the bargain.

It is high time, therefore, for us to look about us too, and endeavour to vie with our neighbours in politeness, as well as power and empire. Towards the end of King James I.'s reign, and in the beginning of his son's, taste made a bold step from Italy to England at once, and scarce staid a moment to visit France by the way. From the most profound ignorance in architecture, the most consummate night of knowledge, Inigo Jones started up a prodigy of art, and vied even with his master Palladio himself. From so glorious an out-set, there was not any excellency that we might not have hoped to obtain, Britain had a rea-

---

calcareous spars, consist almost entirely of lime in chemical combination with carbonic acid or fixed air, the former constituting somewhat less than three-fifths, the latter somewhat more than two-fifths of their whole weight. Hence in scientific language they are called carbonates of lime. The carbonic acid or fixed air may be expelled by heat, or by the addition of any other acid: in the latter case an effervescence takes place, and this effervescence is a very distinctive character of calcareous carbonates, (page 2.)

"Marbles and limestones are with respect to their chemical analysis the same, they differ only in their uses and external character.—(Page 3), *Kidd's Mineralogy.*

Limestone chalk.	
Lime	53
Carbonic acid	42
Silex and alumine	2
Water	3
	100 Kirwan.

* Taking the steeple at 340 feet.

sonable prospect to rival Italy, and foil every nation in Europe beside. But in the midst of these sanguine expectations, the fatal civil war commenced, and all the arts and sciences were immediately laid aside, as no way concerned in the quarrel. What followed was all darkness and obscurity, and it is even a wonder they left us a monument of the beauty it was so agreeable to their natures to destroy.

Wren was the next genius that arose to awake the spirit of science, and kindle in his country a love for that science which had been so long neglected; during his time a most melancholy opportunity offered for art to exert itself in the most extraordinary manner: but the calamities of the present circumstance were so great and numerous, that the pleas of elegancy and beauty could not be heard, and necessity and conveniency took place of harmony and magnificence.

What I mean is this: the fire of London furnished the most perfect occasion that can ever happen in any city, to rebuild it with pomp and regularity; this Wren foresaw, and, as we are told, offered a scheme for that purpose which would have made it the wonder of the world. He proposed to have laid out one large street from Aldgate to Temple-bar, in the middle of which was to have been a large square, capable of containing the new church of St. Paul's, with a proper distance for the view all round it; whereby that huge building would not have been cooped up, as it is at present, in such a manner as nowhere to be seen to advantage at all, but would have had a long and ample vista at each end, to have reconciled it to a proper point of view, and give it one great benefit which, in all probability, it must now want for ever. He farther proposed to rebuild all the parish-churches in such a manner as to be seen at the end of every vista of houses, and dispersed in such distances from each other, as to appear neither too thick nor thin in prospect, but give a proper heightening to the whole bulk of the city as it filled the landscape. Lastly, he proposed to build all the houses uniform, and supported on a piazza, like that of Covent Garden; and, by the water-side, from the Bridge to the Temple, he had planned a long and broad wharf, or key, where he designed to have ranged all the halls that belong to the several companies of the city, with proper warehouses for merchants between, to vary the edifices, and make it at once one of the most beautiful and most useful ranges of structure in the world. But, as I said before, the hurry of rebuilding, and the disputes about property, prevented this glorious scheme from taking place.

In our own times an opportunity offered to adorn the city, in some degree; and though the scarcity of ground in London will not allow as much beauty of situation as one would desire, yet if the buildings were suited to their place, they would make a better figure than they do at present. I have now the late new churches in my eye; amongst all which, there are not five placed to advantage, and scarce so many which are built in taste, or deserve half the money which they have cost; a circumstance which must reflect on the judgments of those who chose the plans, as well as the genius of the architects themselves.

No nation can reproach us for want of expence in our public buildings, but all nations may for our want of elegance and discernment in the execution. In the first place, there are very few of our fine pieces of architecture in sight; they are generally hid in holes and corners, as if they had been built by stealth, or the artists were ashamed of their works; or else they are but essays, or trials of skill, and remain unfinished, till Time himself lays them in ruin. After this, it is unnecessary to mention that our structures are generally heavy, disproportioned, and rather incumbered than adorned; beauty does not consist in expence or decoration; it is possible for a slight building to be very perfect, and a costly one to be very deformed: I could easily name instances of both kinds; but, as I propose to point out to my readers most of the edifices about town that are worth consideration on either side, I will not anticipate my design, but exemplify my meaning, as I proceed, and leave the public to make use of it as they please.

To begin with the remotest extremity of the town; as there were no attempts, till lately, ever made there, to erect any building which might adorn it at all, there was the more necessity to be more particularly careful that the first design of this nature should not miscarry; and yet the four following churches which have been built at Limehouse, Ratcliff, Horsley-down, and Spittal-fields, though they have all the advantage of ground which can be desired, are not to be looked at without displeasure. They are mere Gothic heaps of stone, without form or order, and meet with contempt from the best and worst tastes alike. The last, especially, deserves the severest condemnation, in that it is built at a monstruous expence, and yet is, beyond question, one of the most absurd piles in Europe.

As a fabric of antiquity, it is impossible to pass by the Tower without taking some notice of it, particularly, as it is visited so much by the good people of England, as a place made venerable by the frequent mention which has been made of it in history, and famous for having been the scene of many tragical adventures; but I must caution those of my readers who are unskilled in architecture, not to believe it either a place of strength, beauty, or magnificence; it is large and old indeed, and has a formidable row of cannons before it, to fire on rejoicing days.

The front of the church lately rebuilt in Bishopsgate Street is, I think, more in taste than most about town; the parts it is composed of are simple, beautiful, and harmonious, and the whole deserves to be admired, for pleasing so much, at so little expence.

From hence we may pass on to the South Sea House, and there we shall have some reason to wonder that, when the taste of building is so much improved among us, we see so little sign of it here; at the same expence they might have raised an edifice which would have charmed the most profound judges; beauty is as cheap as deformity with respect to the pocket, but it is easier to find money than genius, and that is the reason so many build and so few succeed.

The tower of St. Michael's, Cornhill, though in the Gothic style of architecture, is undoubtedly a very magnificent pile of building, and deserves very justly to be esteemed the finest thing of that sort in London.

The Monument is undoubtedly the noblest modern column in the world: nay, in some respects it may justly vie with those celebrated ones of antiquity, which are consecrated to the names of Trajan and Antonine. Nothing can be more bold and surprising, nothing more beautiful and harmonious; the bas relief at the base, allowing for some few defects, is finely imagined and executed as well, and nothing material can be cavilled with but the inscriptions round about it. Nothing, indeed, can be more ridiculous than its situation, unless the reason which is assigned for so doing. I am of opinion if it had been raised where Cheapside Conduit stood, it would have been as effectual a remonstrance of the misfortune it is designed to record, and would at once have added an inexpressible beauty to the vista, and received as much as it gave.

The church in Walbrook, so little known among us, is famous all over Europe, and is justly reputed the master-piece of the celebrated Sir Christopher Wren. Perhaps Italy itself can produce no modern building that can vie with this in taste or proportion; there is not a beauty which the plan would admit of, that is not to be found here in its greatest perfection, and foreigners very justly call our judgment in question for understanding its graces no better, and allowing it no higher a degree of fame.

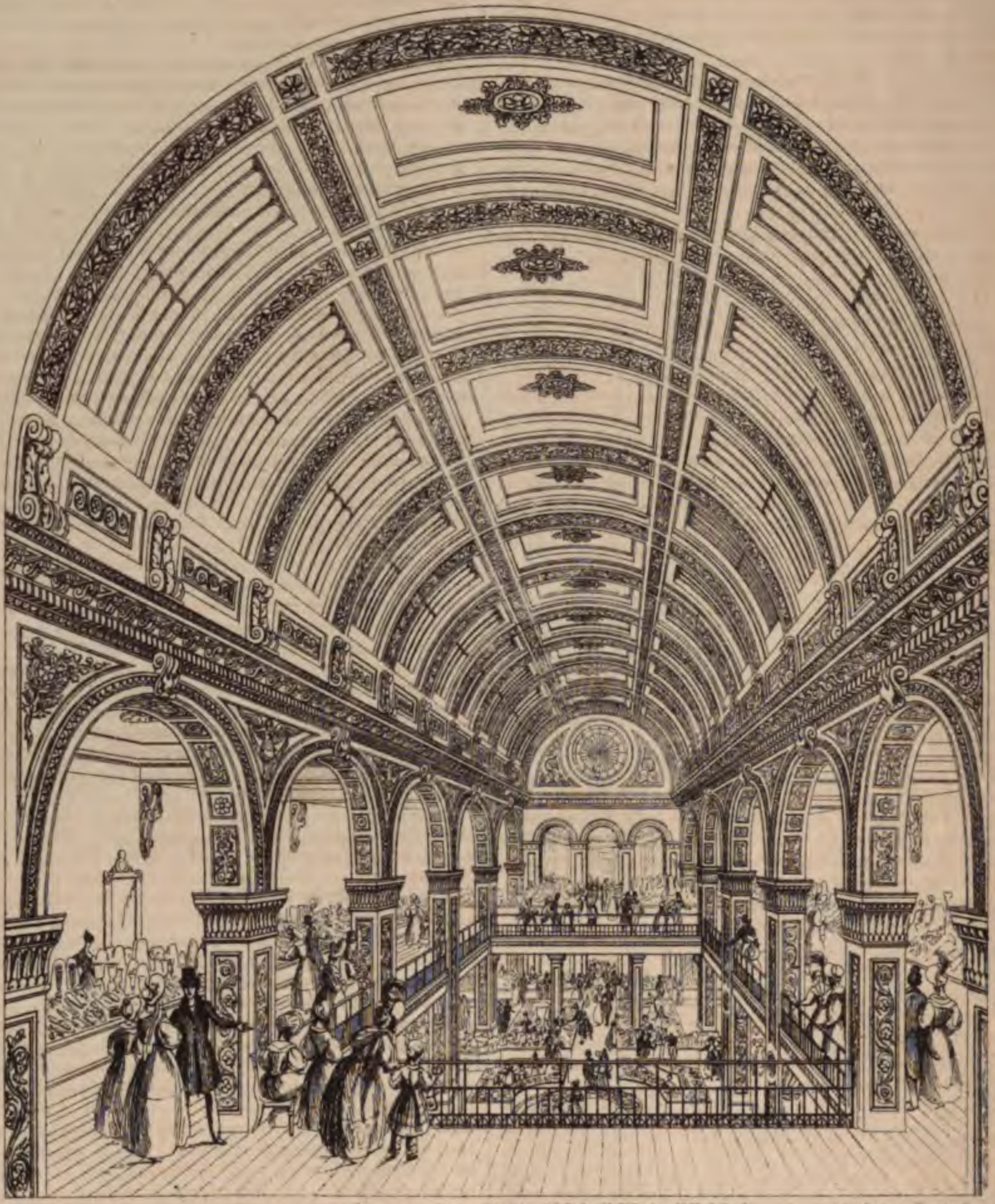
The steeple of Bow church is another master-piece in a peculiar kind of building, which has no fixed rules to direct it, nor is it to be reduced to any settled laws of beauty; without doubt, if we consider it only as a part of some other building, it can be esteemed no other than a delightful absurdity: but if either considered in itself, or as a decoration of a whole city in prospect, not only to be justified but admired. That which we have now mentioned is beyond question as perfect as human imagination can contrive or execute, and till we see it outdone, we shall hardly think it to be equalled.

I think it proper to recommend the steeple of Foster Lane to the attention of the passenger; it is not a glaring pile that strikes the ey at the first view with an idea of grandeur and magnificence: but the the beautiful pyramid it forms, and the just and well-proportione simplicity of all its parts, satisfy the mind so effectually, that nothing seems to be wanting, and nothing can be spared.

The new church in Old-street is so slight and trifling a building th it is not worth the trouble of a visit; for which reason we shall choo rather to cross over to Smithfield, neglecting the *Chartreux* (Charte house), at the same time, because the building is so entirely rude a irregular, that it admits of nothing like criticism: its situation inde in the midst of a garden is fine, and the square in the front of it is least kept in better order than most in town.

In Smithfield we shall see a vast area, that is capable of great beaut but is at present destitute of all; a scene of filth and nastiness, one the most nauseous places in the whole town; it is true, the use whi is made of it as a market is something of an excuse for it, and in some degree atones for the want of that decency which would improve it so much: yet still it is my opinion that ways and means might be found to make it tolerable at least, and an obelisk, pyramid, or statue, in the centre, defended with handsome and substantial rails, would go a great way in so desirable a project.

On one side of this irregular place is the entrance, not the front, of a magnificent hospital; in a taste not altogether amiss, but so erroneous in point of proportion, that it rather offends than entertains; but what is still more provoking, the building itself is entirely detached from the entrance, and though so near a large and noble opening, is in a manner stifled with the circumjacent houses: it is indeed a building in a box or case; and though beautiful in itself and erected at prodigious expence, is so far from giving pleasure to a judge, that he would rather regret its being built at all. It is certain that where



[illegible] by Sydney Smirke Esq. [illegible]

View of the great Saloon of the Pantheon, London,
from the North Gallery.

Civil Engineer and Architects' Journal, June, 1840.

[illegible]

e ground will admit of it, public buildings can hardly be too grand d magnificent; but where they cannot be seen when finished, use d convenience only should be consulted, and a pile of rough stones om the quarry, would answer the end, as well as the marble of Egypt ith the decorations of Greece or Rome.

Newgate, considered as a prison, is a structure of more cost and auty than was necessary, because the sumptuousness of the out-side at aggravates the misery of the wretches within: but as a gate to ich a city as London, it might have received considerable additions oth of design and execution, and abundantly answered the cost in the putation of building.

The Physicians College, in Warwick-lane, Newgate-street, (now ccupied as a market on the ground floor,) a structure little known and eldom talked of, is a building of wonderful delicacy, and eminently eserves to be considered among the noblest ornaments of this city; nd yet so unlucky is its situation, that it can never be seen to advan- ge, may seldom seen at all, and what ought to be conspicuous to very body, is known only to a few, and those too people of curiosity, ho search out their own entertainments, and do not wait for the im- ressions of vulgar reports or common fame, to excite their attention r influence their judgments.

The hall of justice at the Old Bailey, and indeed all the courts I ave ever yet seen in England are justly to be excepted to, as wanting at grandeur, that augustness, that decency, and solemnity which ught to be inseparable from them, in order to give men in general a uitable awe for the place, and strike offenders with a terror, even ore forcible than the sentence they were to undergo. The form of a heatre agrees best with a place of this nature: that part of the build- ng which is the stage, would answer exactly for the bench, the pit for he council, prisoners, &c., and the circle round it, for the spectators: ut the present form of these assemblies is utterly opposite to this egularity, and instead of representing the whole in one grand and omprehensive view, divides it into meanness and confusion.

(To be continued.)

PAPIER MÂCHÉ.

xtracts from an Historical Account of the Application of Papier Mâché for Architectural Ornaments. By Charles Frederick Bielefeld.

WITH AN ENGRAVING, PLATE XI.

Of the Interior of the Pantheon, Oxford Street.

[The following account we have selected from the preface to Mr. ielefeld's work on Papier Mâché ornaments; the subjoined plate hows how far Papier Mâché may be introduced with considerable aste, and a richness of effect produced, which is not so easily ob- ained by any other kind of ornament at the same expence, besides he facility it affords in being fixed immediately the carpenters' work s finished, and painted directly afterwards.]

"Though paper be one of the commonest bodies that we use, there are ery few that imagine it is fit to be employed other ways than in writing, or rinting, or wrapping up of other things, or about some such obvious piece f service, without dreaming that frames of pictures and divers fine pieces of mbossed work, with other curious moveables, may, as trial has informed us, e made of it."—(Of man's great ignorance of the uses of natural things; oyle, vol. iii. page 485, ed. M.DCC.LXXII.

Notwithstanding the name that has been given to the material, which ould seem to imply that it is of French extraction, there is yet very good ason to believe that to England is to be attributed the merit of first apply- g this manufacture to important uses. Light and trivial articles, such as uff-boxes, cups, &c. had, on the Continent, been made of Papier-Mâché for long course of time; but, from the following passage from an article "sur Art de Moulage," in the "Encyclopédie Methodique," we may safely con- cture that here first it was applied to the builder's purposes: "Les Anglois nt en carton les ornamens des plafonds que nous faisons en plâtre: ils sont lus durables; se détachent difficilement, ou s'ils se détachent, le danger est ul et la reparation est peu dispendieuse." (Vol. v. Paris, 1788.) We may ere take occasion to remark, that the writer of the above passage appears to ave perfectly understood the peculiar merits of Papier-Mâché; and it would e impossible to explain more concisely or more accurately than in that short aragraph, the more valuable qualities of this material. The particular circumstances that gave rise to the adoption of Papier-Mâché by the architectural decorator in England, deserves the especial notice of all who are interested in the welfare of our manufactures.

It should be premised, that with the Elizabethan style, or the "rénaissance," of England, enriched plaster ceilings were very generally brought into use, and in the more classic or Italian styles that followed, the same material was still more extensively and more boldly employed. As the art advanced, plaster became partially substituted for carved or panelled wood wainscoting on walls; both in that situation and upon ceilings, foliage of the highest relief and of the richest character, may at the present day be found in the more important edifices remaining of the 17th and beginning of the 18th centuries: these enrichments were generally worked or rather modelled by the hand upon the stucco in its place, whilst still in a soft and plastic state.

As this work had to be done on the spot, and with much rapidity of execution, in order to prevent the stucco from setting before it had acquired the intended form, the art was somewhat difficult; the workman had to design almost as he worked: therefore, to do it well, it was necessary that he should have some of the acquirements and qualities of an artist. This circumstance of course tended very much to limit the number of workmen, and their pay became proportionably large.

It was no unnatural consequence that artisans thus circumstanced assumed a consequence that belonged not to their humble rank in life; it is said that they might have been seen coming to their work girt with swords, and having their wrists adorned with lace ruffles. Such a state of things was, as may be conceived, attended with many inconveniences to their employers; it was scarcely possible to preserve that subordination so essentially necessary in carrying on the business of a builder, and ultimately the workers in stucco, laying aside all restraint, combined together to extort from their employers a most inordinate rate of wages. It would be superfluous here to detail all the circumstances that followed; it is sufficient to state that, as might have been anticipated, the total ruin of their art was the final result of these delusive efforts to promote their individual interests.

Contrivances were resorted to by the masters, which soon supplanted the old mode of working in stucco. The art of moulding and casting in plaster, as previously practised in France, was generally introduced, and the art of preparing the pulp of paper became improved and extended, so as ultimately to render practicable the adoption of Papier-Mâché in the formation of architectural decorations. Thus at last was extinguished the original mode of producing stucco ornaments, and there probably has not been for many years a single individual in England accustomed to that business.

The superior cheapness of the process of casting in plaster brought it into almost universal use; for, although in the course of the last century an immense trade was carried on in the manufacture* of architectural and other ornaments in Papier-Mâché, yet the poverty of taste they generally displayed, and the imperfection of machinery at that time, which prevented this material from coping with plaster in respect to price, ultimately caused its disuse. The manufacturers of Papier-Mâché at that period do not seem to have been aware of the great improvements of which every process of their art proves now to have been susceptible.

A most mischievous effect, however, was produced in the art of decorative designing by this change in the mode of execution. All the deep undercuttings and bold shadows which marked the style of design in the age of Queen Anne, became impracticable when ornaments were to be cast. A meagre, tame, *petite* manner ensued almost of necessity, until by the end of the last century the art of designing architectural ornament had fallen into a deplorable state of imbecility.

The subsequent introduction of Greek ornament formed a new era: the limited capabilities of plaster-casting became then less inconvenient, for the broad, flat character of the Greek style was favourable to the process of casting, and had that manner of designing continued to prevail generally up to the present day, it is probable that no material change would have taken place in the manufacture of ornament. But great fluctuations have occurred in the public taste: the pure and elegant simplicity of Greek ornament is in its nature appreciable only by the more highly cultivated tastes; the generality of persons do not understand its merits; therefore, after the stimulus of novelty had ceased to operate, fashion soon led the public favour into other channels. The bold originality of the Gothic school, the gorgeous and meretricious richness of the Flemish and French schools, the picturesque and fantantic forms of the Elizabethan style, soon found many admirers, and it is this great change in the manner of designing ornament that has given rise to the important improvements in the manufacture of the highly plastic substance called Papier-Mâché. Plaster is totally inapplicable to the exact imitation of the bold florid carvings in the above named styles, whilst to carve in wood all these fanciful forms would occasian a cost far beyond the means of all ordinary purses. As to the putty-composition, a material introduced at the latter end of the last century as a substitute for wood carving in picture frames, &c. its monstrous weight, its brittle, impracticable nature, and the difficulties and heavy expenses necessarily incurred in its manufacture, as well as in fixing it up, render it properly applicable to a very limited range of purposes.

Having made these preliminary remarks upon the origin of Papier-Mâché, and the causes of its improvement and re-introduction, we will proceed to the more important objects of the present brief essay, and describe, for the information of practical men, the mode of applying the material to the various uses for which it is so admirably adapted. We will only premise, that the application of steam power, and the vast improvements that have of late been made in all branches of mechanics, have enabled the present manufacturer to produce a material alike only in name to the Papier-Mâché of the last century: its hard compactness, its strength, its imperishable nature, its tractability (if such an expression may be allowed), the facility with which it may be put together and fixed up, its lightness, the rapidity with which it may be prepared and fixed, and finally its cheapness, are qualities which eminently distinguish it, but which cannot perhaps be fully appreciated but by those who have had extensive experience in its use.

Papier-Mâché is applied to the enriched cornices of bookcases and cabinets, to the mouldings and corners and centre ornaments of paneling on their doors and sides; to the enriched scroll legs of cabinets and pier tables in the old French style; to ornamental brackets for clocks, busts, vases, &c.; to the enriched borders to rooms hung with silk or paper; the ornamental parts for picture and glass frames, no matter how curved and elaborate; also to window-curtain cornices, the canopies of bedsteads, &c. &c. It has been very advantageously used for the latter purpose in the state bed at Chatsworth; and also to the canopy of the Royal Throne in the present House of Lords. For the enrichment of bookcases it is admirably adapted, affording opportunities, if in the Gothic style, of introducing elaborate pinnacles and pendants, rich corbels and pierced frets of open work, deeply undercut rosettes, and spandril and mitre, or intersection ornaments, &c.; also for the exterior cases of organs it has been most advantageously and extensively used: the lightest and most intricate tracery is executed with ease, and an effect produced at a very moderate cost, which by no other means could be obtained without an extravagant expense.

It is needless to add, that when the above mentioned subjects are in classic or other styles, the friezes, the scrolls, consoles, pateras, &c. are among the simplest and most obvious uses of Papier-Mâché.

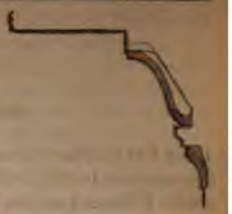
With regard to the mode of fixing Papier-Mâché in cabinet work, perhaps the simplest and yet most accurate rule that can be laid down, is to treat it exactly as if it were wood. It is to be cut with the saw and chisel, and may be bent by steam or heat, planed and cleaned up with sand paper to the smoothest face and to the finest arris, if required; it is to be fastened with brads, needle points, or glue. The larger objects, such as brackets, canopies, &c. can be made either with a wood core, or they can be wholly of Papier-Mâché: in either case, two or three screws at once secure them in their place. When fixed, the work can be painted and grained without any previous preparation whatever; and in gilding, the surface of the work is so much better adapted to receive the gold than that of any other material, that much of the expense and delay usually attendant on the process is saved. The same observation applies to silvering; and it may be added, that there is good evidence (as at Chesterfield House, May Fair, &c.) to prove that the metallic leaf continues untarnished longer on Papier-Mâché than on other substances.

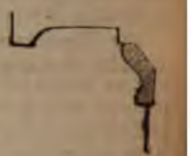
A great variety of brackets, consoles, and cantilevers are made of this substance; indeed, one of the first applications of C. F. Bielefeld's improved Papier-Mâché to architectural purposes, was to form some large consoles and cornices at St. James's Palace on the accession of his late Majesty. Since that time similar work has been fixed up at the Grocers' Hall, the King's College, at the Carlton Club House, the Oxford and Cambridge Club House, British Museum, State Drawing Rooms at Dublin Castle, Grand Lodge Freemasons' Hall, Corn Exchange, &c. Chimney pieces are very effectively decorated in Papier-Mâché, as was formerly much practised by Sir William Chambers and others; specimens of ornamental chimney pieces in the style of Elizabeth and James may be seen in the show rooms. It would, however, be tedious to enumerate all the purposes to which Papier-Mâché can be advantageously applied; it will suffice to repeat, that there is no possible enrichment, in any style, however complicated or elaborate, that may not be readily executed in it. Nor is the manufacturer disposed to limit the application of it to interior work. The improved Papier-Mâché is of too recent introduction to enable us to refer to any example of its use in exterior work further back than about fourteen years; but there are several shop fronts in London that were fitted up at that time, where the Papier-Mâché enrichments are at the present day as sound and perfect as when first turned out of the mould. We may, however, find in the Papier-Mâché of the last century, although of immeasurably inferior quality, abundant proof of its extreme durability in exposed situations. Sir William Chambers's own house in Berners-street, that must be probably three quarters of a century old, has the Papier-Mâché, which enriched the fanciful architecture at the back of the house, in perfect preservation.

At Paris, the Carton-pierre, a substance analogous to Papier-Mâché, but in every way inferior to it, especially as regards its durability, being very absorbent of moisture, and therefore liable to become soft, is largely used for exterior ornaments, even in buildings of the most sumptuous and important character.

As there is good evidence of the durability of the old Papier-Mâché in the open air, it follows of course, that for interior work its permanency may be still more implicitly relied upon. There are many pier-glass frames, chimney-pieces, &c. composed of this substance, remaining in a perfectly sound good condition, that must have been made early in the last century; and a recent examination of the old Papier-Mâché work at Chesterfield House has most satisfactorily proved, that for ceilings it is equally durable; the component parts are, in fact, such as to render it much less likely to decay than the laths or other work to which it may be attached; and in no instance that has ever come under the observation of the manufacturer, has he detected the least indication of its having been attacked by worms, one of the ingredients used being very obnoxious to them. The Papier-Mâché work now remaining in many houses in London and the country, which was put up in the time of Sir William Chambers, appears, wherever it has been examined, in a perfectly sound state, notwithstanding all those original defects in its composition and manufacture which the manufactory has been able effectually to correct.

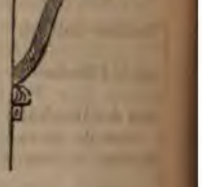
It now only remains to give some general instructions for the fixing up of the work. There is one rule which it will be particularly advisable to note, since it is calculated to save much trouble, and secure perfect truth in the fixing of the enriched members of cornices. In running the plain work of a cornice, it should be remembered to provide in the mould a sinking to receive the Papier-Mâché member. If, for example, it is desired to enrich with foliage the cyma of a cornice, the mould should be formed with a sinking thus: or, should it be desired to insert an enrichment, say an ogee and bead, in the bed-moulding of the cornice, a sinking to receive it should be provided thus:

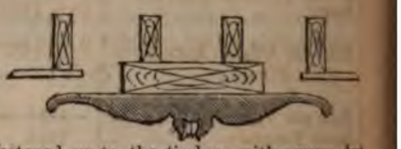




These sinkings need not generally exceed one-eighth of an inch; a raised fillet at the bottom of the enriched moulding would answer the same purpose, the only object being to secure a perfectly continuous and unbroken line.

In cases where a simple cornice would be sufficient, and where it is desirable to have nothing to do with plaster, a small fillet or moulding of wood, nailed to the ceiling and wall with the Papier-Mâché ornament inserted between them, gives a very complete and ornamental finish to the room at a most trifling expense, and without the dirt and delay unavoidably attendant on running plaster mouldings. Where a flower or patera has to be applied to a ceiling, one screw will suffice, unless the patera be of unusual dimensions, to attach it safely to the plaster, taking care that the screws are long enought to reach the joists. Where, however, the flower is intended to cover an opening for ventilation, it will be requisite to block down from the joists; thus screwing the flower to the blocking.





Where ornamental corners are to be applied to a ceiling, they should, if very heavy, be fastened up to the timbers with screws, but generally speaking it would be quite sufficient to use brads, taking their hold on to the laths; this attachment being made still more secure by the use of the cement which is prepared and provided by the manufacturer when required, together with instructions for using it. The same mode of fixing is adopted for frets, friezes, and indeed for all kinds of superficial enrichment, care being at all times taken that brads lay well hold of the laths, for which purpose it is generally expedient to drive the brads in at the hollows, and such parts of the work to be fixed; it is also a useful precaution to drive the brads in a slanting direction, so as to prevent all chance of their drawing. When walls have to be enriched with panels, as is very usual in apartments fitted up in the old French and Italian styles, exactly the same rules for fixing as have been above prescribed for ceilings are to be followed, except that fewer precautions are necessary, as the weight acts differently; where the work is of a very light character even common needle points will be found sufficient, but the cement above mentioned is in all cases an useful addition. With the assistance of the above rules, there is no sort of work in Papier-Mâché that may not be well fitted up by an ordinary joiner.

In drawing up these brief notes on the use of the improved Papier-Mâché, the manufacturer has yet to advert to a new application of it of almost unlimited extent, and one to which a higher degree of importance may justly be attached than any yet described.

There is no art to which the lovers of the Fine Arts, and especially of Sculpture, are more indebted than to the art of moulding and casting in plaster; but for this art we should be almost wholly ignorant of the merits of contemporary sculptors, and the glorious efforts of ancient art would be all but lost to the world. By means of plaster-casts the chef-d'œuvres of all ages are multiplied, and brought from the uttermost corners of the world into the museum of the connoisseur and the studio of the professor.

But how perishable and fragile is a plaster-cast! how cumbrously heavy! how difficult of transport! such indeed are the risks of breakage that no one is willing to pay for a cast, the price that would compensate for the difficulty and expenses necessarily attendant on making a perfect mould and cast. The result is, that the plaster-casts ordinarily sold are most imperfect and unsatisfactory representations of the works of art they are derived from. The new substance now under consideration presents itself to obviate all these inconveniences; for, whilst a copy of any piece of sculpture can be made in it with perfect truth and fidelity, its weight is scarcely one-sixth of that of plaster, and its liability to fracture less than that of stone, marble, or wood.

When these advantages, coupled with economy in price, are considered, it will be easily seen what facilities are now afforded for disseminating throughout the empire a knowledge of the best works of sculpture. The inventor hopes to place within the reach of every individual the enjoyment and advantages derivable from the contemplation and study of the finest specimens of this branch of the Fine Arts.

REVIEWS.

Penny Cyclopædia, Part 87.

ave before directed the attention of our readers, on more than sion to this well conducted publication, and now point out the Paris, on account of the architectural remarks it contains on the principal public buildings, and likewise for the synoptical table which accompanies them, and which is drawn up upon the same plan as those of London and Munich. The arrangement is chronological, and divided into centuries. We extract the latter portion, or that comprising the edifices erected within the present century, more than which we do not consider ourselves at liberty to transfer to our Journal, else we should willingly give the entire table; but whether they take in the work or not, we have no doubt that most of our readers will procure the part containing the article from which our extract is taken.

Nineteenth Century.

	Date.	Architect.	Remarks.
voli	1802	Percier	
leleine	1804-36	Vignon, Huvé, &c.	A Corinthian peristyle of 52 columns (8 at each end) 62 feet high, raised on a stylobate 13 feet high.
es Arts	1804	Cessart & Dillon	For foot-passengers only; arches cast iron, piers stone.
f the Tuileries	1805-10	Percier and Fontaine	Each front has four Corinthian columns (shafts red marble, and bronze capitals), with a central arch and two smaller ones.
ne Column	1806	Gondouin & Lepère	Stone cased with bronze reliefs; total height 141 feet.
l'Etoile	1806-36	Chalgrin, &c. finished by Debret	Width 147 feet, height 162 feet, depth 73 feet. Arch 47 feet wide, 96 feet high.
s Invalides t de Jena)	1806	Lamandé	Five arches, length 518 feet.
e du Palmier	1806-8	Bralle	A column on a pedestal, surmounted by a figure of Fame on a globe. Height to top of capital 49 ft. 3 in.: total height, with statue, 56 feet.
, Chamber of Deputies	1807	Poyet	A single range of twelve columns (44 feet high) beneath a pediment.
	1808-1824	Brogniart & Labarre	A Corinthian peristyle of 64 columns (40 feet high), 14 at each end.
es Affaires Etrangères i d'Orsay)	1810-1837	Bonnard and Lecointe	An extensive pile, of which the projecting portion forming the façade towards the quay is 370 feet, and consists of two orders, Doric and Ionic, surmounted by an attic, and each containing 19 large arcades or windows.
ux Vins	1811-13	Gaucher	
Fountain	1811	Girard	A large circular basin 90 feet in diameter, with other basins or terraces rising from it.
St. Germain	1813	Blondel, M. J. B.	
e Expiatoire	1815-23	Percier and Fontaine	Tetrastyle portico, Roman Doric attached to a square mass, whose three other sides have semicircular projections crowned by semidomes against the attic of the square part.
es Beaux Arts	1824-37	Duban and Labrouste	Two Corinthian orders (one in columns, the other in pilasters), upon a basement. The gateway or screen from Château Gaillon, erected in front of the building.
lumn	1833	Alavoine	Pedestal stone, column bronze, total height 154 feet; 13 feet higher than the Vendôme Column.
ı Carrousel	1834-6	Polenceau	Timber and iron, with stone piers and abutments. Three arches, centre one 187 feet span, and 16½ rise. Total length 558 feet.
le Justice	1834		Interior remodelled and rebuilt chiefly in the Renaissance style.
e Ville	1835	Godde and Lesueur	Restorations, &c. Renaissance style.
)belisk	1836		Raised by Lebas, October 25.
e la Concorde		Hittorff	Embellished with fountains and architectural decorations.
)ame de Lorette	1825-36	Lebas	Portico, tetrastyle Corinthian.
cent de Paul		Hittorff and Lepère	
lonne Nouvelle	1837	Froehlicher and Grisart	
, Faubourg St. Germain	1839	Gau	Gothic.

hould like to see a complete series of such tables for all the l cities of Europe, published separately, and would suggest ne writer in the Cyclopædia, with whom the idea appears to ginated.

Description of the various Plans that have been proposed for ing the Metropolis with Pure Water, also a short Account of ferent Water Companies that now supply London.

upply of water for domestic use is a subject which in all s been regarded as one of great public importance, for, next r which we breathe, water is the most powerful agent in vital . It is a subject, indeed, which every year becomes of deeper particularly to the inhabitants of a densely peopled metro- vitiated air and vitiated water, and to an insufficient supply n purity, is owing the frightful mortality which attacks the ts of towns when compared with those of the country, and that the Report of Mr. Farr to the Registrar General, will ss towards effecting a reform of these evils, than the active of the last ten years, or the labours of parliamentary com- Much certainly has been done within the last ten years towards improving the supply of water, but much, very much, still remains to be done before the companies can be considered to have done their duty. The author of the pamphlet before us would have done wisely if he had omitted the following passage. "It is not intended, in the present day, that the inhabitants of London, generally, complain of the quality of the water supplied to them, although it still seems to be the policy of certain 'artful and mischievous persons' to use the words of a celebrated individual, now no more, by exaggerated statements to promote contention and inflame the passions of the inhabitants," Though these words are supported by a quotation from the great Telford, we must remember that he was speaking on a subject on which he had strong prejudices. Is it at all probable that the companies would have incurred the enormous outlay which they have done during the last ten years, we may say, within limits, to the tune of a million pounds sterling—if there had not been some truth in the statements of these "artful and mischievous persons," would the Grand Junction Company have removed their works from the "former objectionable site near Chelsea (Sewer?) Hospital" to Brentford, and incurred an expense of nearly £200,000, if it had not been for these "artful and mischievous persons." Our author also subjects himself to the same denomination, for he even has had the *temerity* to tell the Companies that the present mode of filtering as practised by them is insufficient effectually to cleanse Thames water of all the impurities which are suspended in it after heavy rains (vide page 9), and he recommends as the most effectual method, the plan of filtering through charcoal, which we shall hereafter notice. We believe that most of the Companies have done their best in endeavouring to improve their supply from the *Thames*, but whether *that* resort be the best for obtaining water is a subject well worthy of inquiry. We believe it is not disputed, by any party, that water obtained by the aid of deep wells and Artesian boring is far better than obtaining the supply from the Thames, as by the latter, enormous expences are annually incurred in filtering the water, besides the expense of pumping first the supply into a reservoir and thence to the mains, whereas by the former process the water might at once be pumped into the pipes, and forced up to the elevated situation, without the expense, trouble, or delay of filtering, or pumping a second time, but the objections to the former plan have been that a sufficient quantity of water cannot be obtained for this great metropolis, and also that any attempt to obtain a supply by such means would materially affect the numerous wells about the metropolis, particularly those which belong to the manufactories and the large breweries, the latter, until within the last 20 years, were supplied by the various companies, but in consequence of the heavy rental the brewers and manufacturers were compelled to pay, they had recourse to the sinking of wells of great extent, and, we believe, we may say safely, not one of them ever failed affording an ample supply, and if the companies do not take care, their other customers will be obliged to resort to the same means, as very little consideration of the geology of London would be sufficient to convince any one that an abundant supply of water for all, exists in the lower strata, in the same manner as at Paris, a description of which, in one of our recent numbers, will serve to illustrate the present subject.

Before we proceed further with our remarks, however, we must refer to the contents of the pamphlet which has given rise to this notice. The work is published anonymously, but we understand that it is by Mr. Peppercorne, a highly respectable member of the profession, and in no way connected with a gentleman of the same name acting as secretary to one of the metropolitan water companies.

The pamphlet first proceeds to describe the several metropolitan companies, how they obtain their supplies of water and the quality of it. It then details the various plans devised by the water companies, or by private individuals, which are divided into three classes:

> 1st. Those which propose the purification of the Thames water either by filtration or by subsidence, or by both combined, and which method has been put in practice on an extensive scale by some of the water companies.
>
> 2nd. Those which suggest the taking of the water supply from a higher part of the river than where it is now obtained.
>
> 3rd. Those which recommend to draw the supply from other sources than the Thames, and to convey it by means of extensive aqueducts to London.
>
> Respecting the first class, it is a well known fact that although filtration through sand, or through sand and gravel, (as in the case of the Chelsea water-works,) produces a perfectly clear and transparent fluid, free from sediment and colour, yet that it is insufficient to free the water from animal or vegetable impurities held in solution, or from any taint which the water may have thereby acquired; but that filtration through charcoal, or through sand and charcoal, as practised to some extent with the water of the Seine at Paris, is capable of removing the whole of the sediment, and also, by a properly regulated system, the entire of the animal and vegetable impurities contained in Thames water taken from the London district.
>
> With respect to the method of subsidence alone in reservoirs, as practised now by almost all the water companies, although a large portion of the muddy sediment contained in Thames water is thereby deposited, yet it is clear that it cannot free the water from all the impurities dissolved in it. The process of subsidence might, it is true, be made to free the water from nearly the whole of the animal impurities contained in it, but in that case the state of rest of the water, to be so purified, ought to continue for a much longer period of time than the companies usually allow, or can afford to allow. It has been ascertained that if Thames water be suffered to remain at rest, completly undisturbed, for a period of several weeks, fermentation will take place in consequence of the presence of animal and vegetable matter, and the liquid will become clear and transparent, with the exception of a small proportion of insoluble sediment, and will lose all unpleasant smell, taste, or colour. This curious fact was ascertained by Dr. Bostock, who communicated the result of his interesting enquiry to the Royal Society in 1829.
>
> Of the second class, it is only necessary to observe, that unless all the water companies, north and south of the Thames, were simultaneously to establish their works as far to the west as at Teddington, no removal to any part within the influence of the tide, could accomplish their intention of supplying a purer water than they now do to the metropolis. * *
>
> In regard to the third and last class of projects that have been submitted to parliament, it is only necessary to state in passing, that the one which seems to have been duly considered by a select committee of the House of Commons so late as 1834, and which was presented by the late Mr. Telford, involves so much difficulty, and the outlay of so exorbitant a capital for the supply of six only out of the eight water companies, that there appears to be no likelihood of its ever being carried into effect. It is not probable, indeed, that any government will authorize the expenditure of £1,200,000 for the construction of two aqueducts, the one sixteen, the other six miles in length, according to Mr. Telford's estimate, in order to bring water *of very questionable purity* from the Verulam and the Wandle to assist *six* only of the water companies of the metropolis.

We shall not stop now to make any inquiry as to the authority, which the author has for stating that the water from the Verulam and Wandle is "of very questionable purity" but shall reserve it until we notice another part of the pamphlet relating to Mr. Telford's evidence.

The author proceeds to give an interesting account of the numerous plans which have been devised since the year 1821, for supplying the metropolis, but as it is not our intention to notice all these schemes, we must confine ourselves to that part which relates to the supply from the Colne near Watford, the locality of the proposed London and Westminster Water Company, now occupying the public attention and a Committee of the House of Lords, and to which the following extracts from the pamphlet alludes.

> Among the numerous schemes for the so-called *better* supply of the metropolis with *pure* water, from other sources than the Thames, there are two which at the present time claim particular attention, from an abortive attempt that has been lately made to revive one at least of them. The one of these relates to the supply of the south side of the metropolis from the river Wandle, as proposed in 1834 by Mr. Telford, and the other of the north side from the Colne, also originally suggested by Mr. Telford, but the idea of which was abandoned by him owing to the insignificancy of its stream unless after heavy rains, when its waters were in a very turbid state. (See Mr. Telford's report March 1834, page 3.)
>
> With respect to the water of the Colne, Mr. Telford's experiments clearly proved that this river was totally inadequate in quantity for the supply of even *three* out of the five Water Companies on the north of the Thames, and that with regard to *quality*, it is frequently in so turbid and muddy a state, caused by its flowing over a *red soil*, as to be totally unfit for use.
>
> Mr. Telford indeed gauged *the river* Colne, and the result of his experiments showed that that river was *totally inadequate* for the supply of even *three* out of the five Water Companies on the north of the Thames.

These quotations, unsupported by other parts of Mr. Telford's report and evidence, would naturally, with a stranger to the subject, lead to the belief that the efforts now being made for establishing the proposed company are entirely delusive, and that all their statements are only intended to dupe the respectable individuals who are disposed to lend it their patronage. We have, therefore, thought it necessary to reperuse the reports and evidence, and also at the beginning of last month to visit the spot where the experiments are now being made.

Let us first explain the situation and course of the river Colne. It unites with the Thames near Isleworth, in its course to Watford, it receives several tributary streams; from Watford it proceeds (still under the name of the Colne) for a distance of about four miles, through Otters Pool, the scene of the company's experiments, and Bushey Mills, the place from which Mr. Telford proposed to take his supply, it then goes on to the place at which the river Verulam falls in; the Colne continuing on as a very small stream beyond this spot, to the north-east, towards Colney and South Mims, and the larger stream, the Verulam, proceeding to the north by St. Alban's, for some distance up the country—therefore it will be observed that the river is called the Colne from its junction with the Verulam to the river Thames. When Mr. Telford stated that the Colne is an insignificant stream, &c., it may be clearly seen by his evidence, that he alluded to that part of the stream above its junction with the Verulam, and he proposed to divert that part of the Colne, so as to prevent it from affording any supply to the intended water-works at Bushey Mills, on the banks of the Colne, but lower down the river, and that in his report he called that part of the river Colne from the junction of the two rivers to Watford "the Verulam," whereas as we have already shewn, it is called "the Colne." We will now give a few extracts from the evidence of Mr. Telford to show that at that part of the Colne "Bushey Mills," there was an ample supply of pure water to be obtained in the driest season without filtration, or pumping, sufficient to supply the principal part of the metropolis. All this evidence the author has carefully kept out of view, for what purpose we will not pretend to say, unless from a misunderstanding of Mr. Telford's evidence.

Mr. Telford in his report to the Lords of the Treasury, February 1834, states, that after having examined the streams which fall into the river Thames in the vicinity of London, he found an abundance of pure, transparent water, within the distance of 16 miles on the north (of London), amply sufficient for the supply of three of the present companies on that side of the Thames, he then goes on to state that the eastern branch (of the Colne) called the Verulam, a transparent stream, occupies the St. Alban's Valley, and about half way between St. Albans and Watford, the Colne joins the Verulam; but, unless after heavy rain, the Colne is an insignificant stream, and at such time very muddy, wherefore it is intended to exclude the Colne from furnishing any part of the supply of water.

Mr. Telford farther states in this report that "at Watford Mill" (near the spot the proposed company intend to erect their works), "in the autumn of 1833, being the driest season, as regards the supply of rivers, experienced during the last half century, the Verulam river produced upwards of 30 cubic feet of water per second; being more than double the quantity supplied by the three companies in the year 1828, namely, 13 cubic feet per second;" and as a farther proof, to show that Mr. Telford proposed taking his supply from near the spot, the proposed company have selected, he says, "Immediately above the commencement of the intended London Aqueduct, about two miles above Watford, the valley of the river Verulam affords a commodious situation for extensive reservoirs of water, and for allowing it to settle, if such should hereafter be deemed requisite. From this place a covered aqueduct may be made to descend with a uniform inclination of 18 inches per mile to Primrose Hill, terminating in a set of extensive receiving and distributing reservoirs, at the height of 146 feet above high water Trinity."

This report is again supported by the subsequent evidence of Mr. Telford, given in the report from the select committee of the House of Commons, 1834, from which we select the following.

23. What part of the River Verulam do you take the first portion of your supply from?—The supply is taken about half way between Watford and St. Albans; the whole supply for the north side is taken there.

24. Is it from a place called Grove Mill?—No, we do not take any from Grove Mill; Bushey Mill is the place. We make no use of the waters of the Gade. There are six paper-mills immediately above Grove Mill.

29. With reference then to the River Verulam, you think that, as it would only be necessary to apply it to the districts now served by the three companies at the west end of London, that the River Verulam would supply a quantity sufficient?—Quite so; for what I have estimated is without reservoirs; but from the usual summer supply of the river, a great deal might be added if it were necessary; perhaps a third more by making reservoirs for retaining flood water in that valley, but at present that is not wanted, because the quantity in the dryest season known for thirty years, was upwards of 30 cubic feet per second, which is more than double what the three companies have now.

35. There is no other part of the Colne according to your opinion then that would furnish an improved supply to London, except this River Verulam, which you would take unpolluted, at the point of junction with the Colne?—Below the junction of the Colne. We must divert the Colne. The Colne has in summer time very little water in it; we could not get a cubic foot of water per second; in rainy weather there is a considerable quantity, but as it passes through a red soil, it is very muddy, and therefore we must divert it, and never let it go into the River Verulam at all, until it has passed the point where the London aqueduct is taken off.

36. But alluding to those delta streams which the various sources commonly called the Colne eventually form, is it your opinion that any of those branches are sufficiently pure and good for the supply of London?—The Verulam is the only one.

37. No other branch of the Colne is sufficiently good for the supply of London?—No, not the Colne.

69. Then none of the branches of the Colne which appear to lay more conveniently near to London, are, in your opinion, fit for the supply?—Not so fit as the Verulam by any means.

70. Not in point of purity of water, nor being able to get high service?—Just so; those were the two reasons that struck me.

71. Did you propose to make a covered aqueduct?—Yes, I did.

87. Where does the Verulam fall into the Colne?—It falls in about half way between Watford and St. Albans.

88. Are you aware of any ornamental sheets of water upon the Colne below the point at which you propose to divert the water by the aqueduct for the supply of London?—No, I am not.

89. Did you search to ascertain whether there were any or not?—There were none occurred to me.

90. The Committee observe that the stream which is commonly called the Colne, from St. Albans down to Watford, until it arrives at Otter's Pool, is not, in point of fact, the river which you mean by the Verulam?—Yes, the St. Albans river is the Verulam.

91. You have stated that in dry weather that smaller branch which is called the Colne, and which flows in the neighbourhood of Otter's Pool, has very little water?—It had not a cubic foot per second when we measured it twice.

92. Well then, in dry weather every seat which is below Otter's Pool must feel the abstraction of this River Verulam, every seat between that and the Thames?—No doubt of it.

93. Will you tell the Committee the minimum of water that runs down the Verulam at the place where you propose to take from it?—Thirty cubic feet was the minimum.

94. In what time?—Per second.

95. Will you also tell the Committee what is the largest quantity or the maximum quantity of water that you expect would be necessary to supply the metropolis?—I recommend to take the power of the whole 30 feet.

96. But in your Report you have stated the supply at present of the metropolis to be about 13 feet from those three companies?—Yes.

1334. Why do you recommend the plan of taking the water either from the Verulam or from the Wandle, in preference to taking it from Richmond, provided there is filtration in both instances; provided both are filtered, why should you prefer taking it from the Wandle and the Verulam in preference to taking the water from the Thames at Richmond?—In the first place the appearance of the water of both the Wandle and Verulam was very tempting, being remarkably pure and transparent; and in the next place, as I have already stated, my plan saves both filtering and pumping.

1335. Would not the expense of the aquednct more than equal the expense of filtering and pumping s—I think it is a more natural way of supplying the water than having recourse to artificial means, if you can get it.

1336. There is no objection to use artificial means to accomplish any object?—No.

1337. Do you not, in fact, by your plan, really buy the power in the shape of compensation to the mill owners?—We do.

1338. And that power is already possessed and in existence in the shape of steam-engines, by the present company?—Yes.

1339. Will you tell the Committee in your own way why we ought to prefer this at the expense of £1,200,000?—It would be a much more perfect scheme with respect to supplying the town, and much less objectionable to the people.

1340. In what less objectionable?—Because there are many strong objections to the use of Thames water.

1341. Without referring to the prejudice against the Thames water, what would be your recommendation, supposing there was no such prejudice?—*I should recommend my own plan as being the best.*

1342. Is it not infinitely more expensive?—Yes, more expensive, I dare say.

1343. Would it not increase very much the expense which we are now put to for water in the metropolis?—It might to a small extent; but the metropolis should certainly enjoy the purest water that can be procured.

1344. That would not be desirable?—Not if you can be well served without it, certainly.

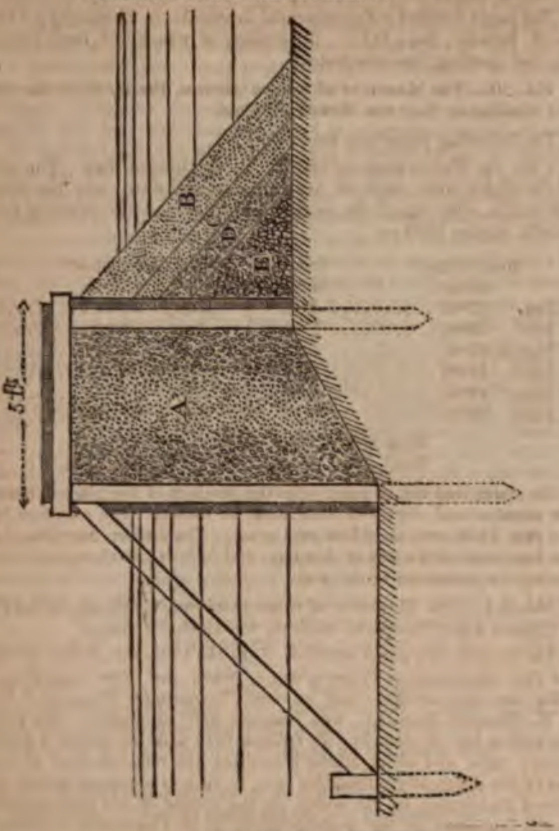
1345. Can you say it will not be as well supplied without that expense by taking it from Richmond?—I do not think so good a supply could be got at Richmond.

1346. If the companies would deliver the Richmond water filtered, would you say it was an objectionable supply?—Filtering takes out only what is mechanically suspended in the water, not what is dissolved.

From these extracts, we think there is ample testimony to show that a very copious supply of pure water may be obtained from that part of the Colne (called by Telford the Verulam), at Bushey Mills, for serving a large portion of the metropolis. Now it is near this spot that the promoters of the Company are carrying on their experiments, not intending at present to take the supply from the river itself, but from borings down to the springs, from which as the appearance of those already reached will show, in several parts of the Valley at a distance of nearly a mile from each other, the water rises to within 18 inches of the surface, and thus it is expected an ample quantity of water will be obtained, independent of the river Colne or Verulam, sufficient to supply the greater part of the metropolis without at all affecting the river. The Company are determined fairly to test the experiments for this purpose, and are now erecting a steam engine to ascertain what quantity of water can be really obtained. From the evidence of Mr. Telford already given as to the river coupled with the supply from borings, it appears beyond a doubt that an abundance of excellent water can be obtained without filtering or pumping. We think that the promoters are deserving of praise for the exertion which they are now making to bring the question to an issue, and if they can show that a large supply can be obtained sufficiently to provide water for at least three of the companies, it will be a great boon, not only to the public, but to the companies themselves, as we conceive it would be to the interest of all parties, that the old companies should take their supply from the new company, and thereby save the great and heavy expences of pumping and filtering which they are now obliged to adopt; as according to the evidence of Mr. Telford the new company will be able to supply the water in London at an elevation of 146 feet above Trinity datum, a height quite sufficient for the highest cistern of any part of London to be served by gravity.

We have extended our notice to a greater length than we originally intended, but the importance of the subject has led us on imperceptibly, we must therefore defer further notice of this interesting pamphlet, which affords abundance of materials for consideration—before we conclude we shall give the description of a proposed filtering apparatus designed by the author, and another which has been adopted in Switzerland.

PROPOSED FILTERING APPARATUS.



Section of Filterer.

REFERENCE.

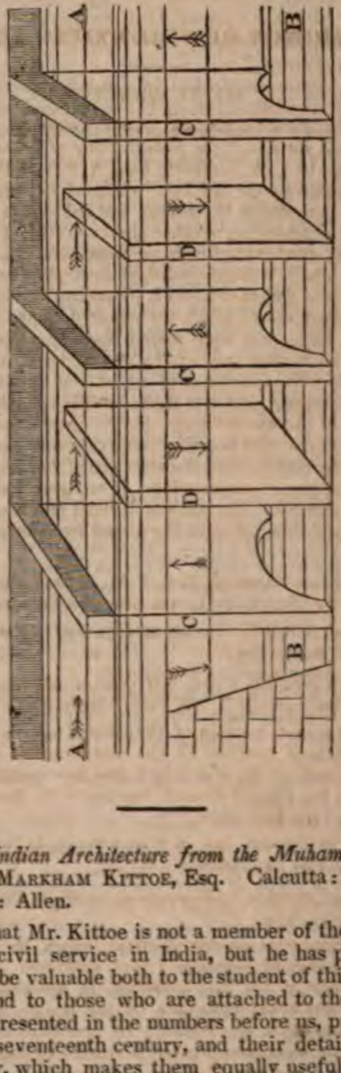
A, charcoal medium (the finest in the centre). B, fine sand. C, coarse sand. D, fine gravel, and pebbles. E, large gravel, and broken pottery.

The above is a sketch of a filtering apparatus, in which charcoal is proposed to be employed, both in a fine and coarse state, the finest being in the centre, as shown. In this case, lateral filtration by a head of water, is to be preferred to an extended surface over which the filtering materials are laid, and where the water percolates through, as in the first place, the materials, (the charcoal in particular,) will be more accessible at all times for cleansing, or renewing, when required. The charcoal, in fact, might be taken out and renewed, without interfering in the slightest way with the rest of the filtering materials, being separated from the gravel and sand, by the perforated planking, as shown in the sketch.

In the next place, the disposition of the sand, &c., the finest being placed outermost, at its natural slope of about 30° or 35°, would in a great measure supersede the necessity for having the surface scraped frequently, as done at the Chelsea water works, for there would be a *natural tendency*, in proportion as the outer layer of sand became loaded with the sediment and particles which it would arrest, for the sand to *slide down* to the base of the slope, where the sediment, &c., would accumulate, and from whence it might be easily removed. All that would be required in that case, would be to renew occasionally the outer layer of sand, which might be done with the greatest ease from the top of the filter-bank, without disturbing the remainder. It should be observed that where the sand comes in contact with the planking near the top of the structure, the planks should be laid with a close joint, to prevent the sand from being washed through.

Thirdly, the proposed method would be far less expensive, as regards the first cost, than the method of filtering by descent; as the construction of the frame-work would be entirely of timber, it could be put together by any carpenter at a trifling expense. The plan proposed would, in fact, combine the advantages of two distinct filters, acting in very different ways, with very little more trouble or expense, than would be involved in the construction of one only. With respect to the length of time during which the charcoal would retain its purifying qualities, it appears from Mr. Lowitz's experiments, before mentioned, that charcoal retained its antiputrescent properties *for a whole year*; and therefore, if the supply had to be renewed but once in that time, the expense would be but small. This must be, however, a matter of experiment; probably it might be found that by removing the charcoal from time to time, washing it well, and *exposing it to the light and air*, for a few days, it would part with whatever putrescent particles it had absorbed from the water, and might be made use of over again.

In order to facilitate the deposition and subsidence of the grosser impurities and sediment, previous to the water passing through the above filter-bank, a very simple and ingenious method might be employed, which has been put in practice with complete success in Switzerland, for purifying a stream of water, and which was described by Sir Henry Englefield, in the Philosophical Journal, so far back as 1804. It consists of a structure of timber or masonry, as shown in the perspective sketch below, where A A is the upper surface of the stream to be purified, and B B the bottom. The channel, or cut through which the water flows is divided into several chambers by the parallel partitions C, C, C, alternately rising above the surface level of the stream, and *open at the bottom*, while the intermediate partitions D, D, do not rise *within several feet* of the surface, and are continued to the bottom. It is obvious that the course of the water must be in the direction of the arrows, and in this repeated slow ascent and descent, all floating impurities will be left at the top, while the sediment and heavier impurities will subside to the bottom. The sediment, &c., may be easily removed and the apparatus cleansed, by sending down persons between the walls, and the operation would be facilitated by giving to the bottom of the cut or canal, the form of an inverted arch. The spaces between the partition walls might be partly filled with coarse filtering materials, such as broken pottery, or coarse gravel and pebbles, &c.



Filter used in Switzerland.

Illustrations of Indian Architecture from the Muhammadan Conque downwards, by MARKHAM KITTOE, Esq. Calcutta: Thacker & Co 1838. London: Allen.

We presume that Mr. Kittoe is not a member of the profession, but attached to the civil service in India, but he has produced a work which cannot but be valuable both to the student of this specific branch of architecture, and to those who are attached to the art in general. The buildings represented in the numbers before us, principally belong to the end of the seventeenth century, and their details are illustrated with an accuracy, which makes them equally useful and interesting. It is singular to trace in the buildings of Delhi or Agra some of the commonest ornaments of our own drawing rooms, and Mr. Kittoe's work presents variations of them which might be introduced with advantage here. Some of the trellis work in stone is particularly admirable, and would look extremely well in iron, or applied for grained ceilings, the variations of honeysuckle ornament are also well worthy of attention. These numbers are indeed a great accession to our stock of works on ornament, and Mr. Kittoe deserves the highest praise for producing a work so valuable in despite of all the difficulties of the Indian press. To us this work is also gratifying as it is a proof of our labours having penetrated there and been appreciated, and we cannot but recommend to architects and amateurs in the different parts of our empire to imitate Mr. Kittoe's excellent example, there is plenty of field in Malta, the Ionian Isles, Aden, our vast Indian empire, and during the several military expeditions. Much might be done by such observations to increase our stock of architectural works.

RICAUTI'S *Rustic Architecture.* London: Weale, 1840.

The first number of this work opens with the design and details of a cottage in the Elizabethan style, which, if it be a fair specimen of its successors, is highly promising. We are glad to see the taste which exists among our nobility for the erection of ornamental farm buildings, and publications of this nature are highly calculated to promote it. The example of the late Duke of Sutherland on his estates in Staffordshire, we trust, will have a lasting effect.

LITERARY NOTICE.

Mr. Jobbins has published a Map of the Environs of London, 30 miles round, at a scale of 3 miles to the inch, with the railways delineated, which for cheapness and completeness can vie with any.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

ROYAL SOCIETY.

Jan. 16.—J. W. LUBBOCK, Esq., V. P. and Treasurer, in the Chair.

A paper was read entitled, "*On Nobili's Plate of Colours,*" in a letter from J. P. Gassiott, Esq., to J. W. Lubbock, Esq., V. P. and Treasurer.

The effect produced by the late Sig. Nobili, of inducing colours on a steel plate, excited the curiosity of the author, and led him to the invention of the following method of producing similar effects.—Two of Professor Daniell's large constant cells were excited with the usual solutions of sulphate of copper and sulphuric acid. A highly polished steel plate was placed in a porcelain soap-plate, and a filtered solution of acetate of lead poured upon it. A piece of card board, out of which the required figures had been previously cut with a sharp knife, was then placed upon the steel plate. Over the card, and resting on it, there was fixed a ring of wood, a quarter of an inch thick, and the inner circumference of which was of the same size as the figure. A convex copper plate was made, so that its outer edge might rest on the inner part of the wooden ring; and its centre placed near, but not in actual contact with, the card board. Connexion was then made by the positive electrode of the battery with the steel plate; the negative being placed in the centre of the copper convex plate. The figure was generally obtained in from 15 to 35 seconds. If a concave, instead of a convex plate be used, the same colours are obtained as in the former experiment, but in an inverse order.

Jan. 23.—SIR JOHN BARROW, Bart. V. P., in the chair.

The Rev. John Pye Smith, D.D., was elected a Fellow.

A paper was read entitled, "*On the structure of Normal and Adventitious Bone.*" By Alfred Smee, Esq.

"*An attempt to establish a new and general Notation, applicable to the doctrine of Life Contingencies.*" By Peter Hardy, Esq.

After premising a short account of the labours of preceding writers, with reference to a system of notation in the mathematical consideration of life contingencies, the author enters at length into an exposition of the system of symbols which he has himself devised, together with the applications which they admit of in a variety of cases.

Jan. 30.—J. W. LUBBOCK, Esq., V.P. and Treasurer, in the Chair.

James Annesley, Esq., was elected a Fellow.

A paper was read, entitled "*Observations on Single Vision with two Eyes.*" By T. Wharton Jones, Esq.

The author animadverts on the doctrine which Mr. Wheatstone, in his paper on the Physiology of Binocular Vision, published in the Philosophical Transactions for 1838, p. 371, has advanced, in opposition to the received theory of single vision being dependent on the images of objects falling on corresponding points of the two retinæ. He maintains that, under these circumstances, the two impressions are not perceived by the mind at the same instant of time, but sometimes the one and sometimes the other. If one impression be much stronger than the other, the former predominates over, or even excludes, the other; but still the appearance resulting from the predominating image is, nevertheless, in some manner influenced by that which is not perceived. He supposes that there are compartments of the two retinæ, having certain limits, of which any one point or papilla of the one corresponds with any one point of the other, so that impressions on them are not perceived separately; and considers that this hypothesis, combined with the principle above stated, is required, in order to explain the phenomena in question.

Feb. 6.—J. W. LUBBOCK, Esq., V.P. in the Chair.

John Parkinson, Esq., and the Rev. Charles Pritchard, M.A., were elected Fellows.

A paper was read, entitled "*Observations on the Blood-corpuscles of certain species of the genus Cervus.*" By George Gulliver, Esq.

Feb. 13.—The Marquis of Northampton, President, in the Chair.

Martin Barry, M.D., and Joseph Phillimore, LL.D., were elected Fellows.

The paper entitled "*Experimental Researches in Electricity; 16th series:*" by M. Faraday, Esq., D.C.L., the reading of which had been commenced at the last meeting, was concluded.

Feb. 20.—The MARQUIS of NORTHAMPTON, President, in the Chair.

J. Caldecott, Esq. was elected a Fellow.

The following paper was read :—

"*On the Wet Summer of* 1839." By L. Howard, Esq. The observations of the author were made at Ackworth, in Yorkshire; and the following are his results, with regard the mean temperature and the depth of rain, in each month, during 1839 :—

	Mean temperature.	rain in inches.		Mean temperature,	rain in inches.
Jan.	37·04°	1·13	July,	59·30°	5·13
Feb.	39·64	2·14	Aug.	58·09	2·94
March,	39·08	3·21	Sept.	54·49	3·43
April,	44·09	0·58	Oct.	48·39	3·40
May,	49·94	0·38	Nov.	43·14	4·54
June,	56·35	4·89	Dec.	37·29	1·85

Mean temperature of the year 47·24°.
Total depth of rain, in 1839, 33·62 inches.

He states that the climatic mean temperature of the place is about 47°, and the mean annual depth of rain about 26 inches. The excess of rain during the year 1839, was, therefore very great. The author describes the effect of the hurricane of the 7th of January, and follows the changes of the weather during the remainder of the year.

March 5.—The MARQUIS of NORTHAMPTON, President, in the Chair.

Captain John Theophilus Boileau, was elected a Fellow.

The reading of a paper entitled, "*On the Chemical Action of the Rays of the Solar Spectrum on Preparations of Silver and other Substances, both metallic and non-metallic; and on some Photographic Processes,*" by Sir John F. W. Herschel, Bart. &c., was resumed and concluded.—The object which the author has in view in this memoir is to place on record a number of insulated facts and observations respecting the relations both of white light, and of the differently refrangible rays, to various chemical agents which have offered themselves to his notice in the course of his photographic experiments, suggested by the announcement of M. Daguerre's discovery. After recapitulating the heads of his paper on this subject, which was read to the Society on the 14th of March 1839, he remarks, that one of the most important branches of the inquiry, in point of practical utility, is into the best means of obtaining the exact reproduction of indefinitely multiplied fac-similes of an original photograph, by which alone the publication of originals may be accomplished; and for which purpose the use of paper, or other similar materials, appears to be essentially requisite. In order to avoid circumlocution, the author employs the terms *positive* and *negative* to express, respectively, pictures in which the lights and shades are the same as in nature, or as in the original model, and in which they are the opposite; that is, light representing shade; and shade, light. The terms *direct* and *reverse* are also used to express pictures in which objects appear, as regards right and left, the same as in the original, and the contrary. In respect to photographic publication, the employment of a camera picture avoids the difficulty of a double transfer, which has been found to be a great obstacle to success in the photographic copying of engravings or drawings. The principal objects of inquiry to which the author has directed his attention in the present paper, are the following.

1. The means of fixing photographs; the comparative merits of different chemical agents for effecting which, such as hyposulphite of soda, hydriodite of potass, ferrocyanate of potass, &c., he discusses at some length; and he notices some remarkable properties, in this respect, of a peculiar agent which he has discovered.

2. The means of taking photographic copies and transfers. The author lays great stress on the necessity, for this purpose, of preserving, during the operation, the closest contact of the photographic paper used with the original to be copied.

3. The preparation of photographic paper. Various experiments are detailed, made with the view of discovering modes of increasing the sensitiveness of the paper to the action of light; and particularly of those combinations of chemical substances which applied either in succession or in combination, prepare it for that action. The operation of the oxide of lead in its saline combinations as a mordant is studied; and the influence which the particular kind of paper used has on the result, is also examined; and various practical rules are deduced from these experiments. The author describes a method of precipitating on glass a coating possessing photographic properties, and thereby of accomplishing a new and curious extension of the art of photography. He observes, that this method of coating glass with films of precipited argentine, or other compounds, affords the only effectual means of studying their habitudes on exposure to light, and of estimating their degree of sensibility, and other particulars of their deportment under the influence of reagents. After stating the result of his trials with the iodide, chloride, and bromide of silver, he suggests that trials should be made with the fluoride,

from which, if it be found to be decomposed by light, the corrosion of the glass, and consequently an etching, might possibly be obtained, by the liberation of fluorine. As it is known that light reduces the salts of gold and of platinum, as well as those of silver, the author was induced to make many experiments on the chlorides of these metals, in reference to the objects of photography; the details of which experiments are given. A remarkable property of hydriodic salts, applied, under certain circumstances, to exalt the deoxidating action of light, and even to call into evidence that action, when it did not before exist, or else was masked, is then described.

4. The chemical analysis of the solar spectrum forms the subject of the next section of his paper. It has long been known that rays of different colours and refrangibilities exert very different degrees of energy in effecting chemical changes; and that those occupying the violet end of the spectrum possess the greatest deoxidating powers. But the author finds that these chemical energies are distributed throughout the whole of the spectrum; that they are not a mere function of the refrangibility, but stand in relation to physical qualities of another kind, both of the ray and of the analyzing medium; and that this relation is by no means the same as the one which determines the absorptive action of the medium on the colorific rays. His experiments also show that there is a third set of relations concerned in this action, and most materially influencing both the amount and the character of the chemical action on each point of the spectrum; namely, those depending on the physical qualities of the substance on which the rays are received, and whose changes indicate and measure their action. The author endeavoured to detect the existence of inactive spaces in the chemical spectrum, analogous to the dark lines in the luminous one; but without any marked success. The attempt, however, revealed several curious facts. The maximum of action on the most ordinary description of photographic paper, namely, that prepared with common salt, was found to be, not beyond the violet, but about the confines of the blue and green, near the situation of the ray F in Fraunhofer's scale: and the visible termination of the violet rays nearly bisected the photographic image impressed on the paper: in the visible violet rays there occurred a sort of minimum of action, about one-third of the distance from Fraunhofer's ray H, towards G; the whole of the red, up to about Fraunhofer's line C appears to be inactive; and lastly, the orange-red rays communicate to the paper a brick-red tint, passing into green and dark blue. Hence are deduced, first, the absolute necessity of perfect achromaticity in the object-glass of a photographic camera: and secondly, the possibility of the future production of naturally coloured photographs.

5. The extension of the *visible* prismatic spectrum beyond the space ordinarily assigned to it, is stated as one of the results of these researches; the author having discovered that beyond the extreme violet rays there exist luminous rays affecting the eyes with a sensation, not of violet, or of any other of the recognized prismatic hues, but of a colour which may be called *lavender-grey*, and exerting a powerful deoxidating action.

6. Chemical properties of the red end of the spectrum. The rays occupying this part of the spectrum were found to exert an action of an opposite nature to that of the blue, violet, and lavender rays. When the red rays act on prepared paper in conjunction with the diffused light of the sky, the discolourating influence of the latter is suspended, and the paper remains white; but if the paper has been already discoloured by ordinary light, the red rays change its actual colour to a bright red.

7. The combined action of rays of different degrees of refrangibility is next investigated; and the author inquires more particularly into the effects of the combined action of a red ray with any other single ray in the spectrum; whether any, and what differences exist between the joint, and the successive action of rays of any two different and definite refrangibilities; and whether this action be capable, or not, of producing effects, which neither of them, acting alone, would be competent to produce. The result was that, although the previous action of the less refrangible rays does not appear to modify the subsequent effects produced by the more refrangible; yet the converse of this proposition does not obtain, and the simultaneous action of both produces photographic effects very different from those which either of them, acting separately are capable of producing.

8. In the next section, the chemical action of the solar spectrum is traced much beyond the extreme red rays, and the red rays themselves are shown to exercise, under certain circumstances a blackening or deoxidating power.

9. The author then enters into a speculation suggested by some indications which seem to have been afforded of an absorptive action in the sun's atmosphere; of a difference in the chemical agencies of those rays which issue from the central parts of his disc, and those which, emanating from its borders, have undergone the absorptive action of a much greater depth of his atmosphere; and consequently of the existence of an absorptive solar atmosphere extending beyond the luminous one.

10. An account is next given of the effect of the spectrum on certain vegetable colours, as determined by a series of experiments, which the author has commenced, but in which the unfavourable state of the weather has, as yet, prevented him from making much progress.

11. The whitening power of the several rays of the spectrum under the influence of hydriodic sals, on paper variously prepared, and previously darkened by the action of solar light. The singular property belonging to the hydriodate of potash of rendering darkened photographic paper susceptible of being whitened by further exposure to light, is here analyzed, and shown to afford a series of new relations among the different parts of the spectrum, with respect to their chemical actions.

12. The Analysis of the Chemical Rays of the Spectrum by absorbent media, which forms the subject of the next section, opens a singularly wide field of inquiry; and the author describes a variety of remarkable phenomena which have presented themselves in the course of his experiments on this subject. They prove that the photographic properties of coloured media do not conform to their colorific character: the laws of their absorptive action as exerted on the chemical, being different and independent of those on the luminous rays: instances are given of the absence of any darkening effect in green and other rays of the more refrangible kind, which yet produce considerable illumination on the paper that receives them.

13. The exalting and depressing power exercised by certain media, under peculiar circumstances of solar light, on the intensity of its chemical action. This branch of the inquiry was suggested by the fact, noticed by the author in his former communication, that the darkening power of the solar rays was considerably increased by the interposition of a plate of glass in close contact with the photographic paper. The influence of various other media, superposed on prepared paper, was ascertained by experiment, and the results are recorded in a tabular form.

14. The paper concludes with the description of an *Actinograph*, or self-registering photometer for meteorological purposes: its objects being to obtain a permanent and self-comparable register and measure, first, of the momentary amount of general illumination in the visible hemisphere, which constitutes day-light; and secondly, of the intensity, duration, and interruption of actual sunshine, or, when the sun is not visible, of that point in the clouded sky behind which the sun is situated. In a postscript, dated March 3rd, 1840, the author states that he has discovered a process by which the colorific rays in the solar spectrum are made to affect a surface properly prepared for that purpose, so as to form what may be called a *thermograph* of the spectrum; in which the intensity of the thermic ray of any given refrangibility is indicated by the degree of whiteness produced on a black ground, by the action of the ray at the points where it is received at that surface, the most remarkable result of which is the insulation of *heat-spots* or thermic images of the sun quite apart from the great body of the thermic spectrum. Thus the whole extent over which prismatic dispersion scatters the sun's rays, including the calorific effect of the least, and the chemical agency of the most refrangible, is considerably more than twice as great as the Newtonian coloured spectrum. In a second note, communicated March 12, 1840, the author describes his process for rendering visible the thermic spectrum, which consists in smoking one side of very thin white paper till it is completely blackened, exposing the white surface to the spectrum and washing it over with alcohol. The thermic rays, by drying the points on which they impinge more rapidly than the rest of the surface, trace out their extent and the law of their distribution by a whiteness so induced on the general blackness which the whole surface acquires by the absorption of the liquid into the pores of the paper. He also explains a method by which the impression thus made, and which is only transient, can be rendered permanent. This method of observation is then applied to the further examination of various points connected with the distribution of the thermic rays, the transcalescence of particular media, and the polarization of radiant heat (which is easily rendered sensible by this method), &c. The reality of more or less insulated spots of heat distributed at very nearly equal intervals along the axis of the spectrum (and of which the origin is *probably* to be sought in the flint glass prism used—but *possibly* in atmospheric absorption) is established. Of these spots, two of an oval form, are situated, the one nearly at, and the other some distance beyond the extreme red end of the spectrum, and are less distinctly insulated; two, perfectly round and well insulated, at greater distances in the same direction; and one, very feeble and less satisfactorily made out, at no less a distance beyond the extreme red than 422 parts of a scale in which the whole extent of the Newtonian coloured spectrum occupies 539.

A paper was also read entitled, "*Remarks on the Theory of the Dispersion of Light, as connected with Polarization.*" By the Rev. Baden Powell, M.A. Since the publication of a former letter on the same subject, the author has been led to review the theory in connexion with the valuable illustrations given by Mr. Lubbock of the views of Fresnel; and points out, in the present supplement, in what manner the conclusions in that paper will be affected by these considerations.

A paper was also read, entitled, "*Further Particulars of the Fall of the Cold Bokkeveld Meteorite.*" By Thomas Maclear, Esq., F.R.S., in a letter to Sir J. F. W. Herschel, Bart.—This communication, which is supplementary to the one already made to the Society by Mr. Maclear, contains reports, supported by affidavits, of the circumstances attending the fall of a meteoric mass in a valley near the Cape of Good Hope. The attention of the witnesses had been excited by a loud explosion which took place in the air, previous to the descent of the aerolite, and which was attended by a blue stream of smoke, extending from north to west. Some of the fragments which had been seen to fall, and which had penetrated into the earth, were picked up by the witnesses. One of them falling on grass caused it to smoke: and was too hot to admit of being touched. The mass which was sent to England by H.M.S. *Scout*, weighed, when first picked up, four pounds. The paper is accompanied by a map of the district, showing the course of the aerolite.

A paper was also read, entitled, "*An account of the Shooting Stars of* 1095 *and* 1243." By Sir Francis Palgrave, K.H.—The author gives citations from several chronicles of the middle ages, descriptive of the remarkable appearance of shooting stars which occurred on the 4th of April, 1095, on the testi-

A paper was read, "*On the Classification of Egyptian Architecture*," by Mr. George Alexander, the tendency of which was to show, that many buildings, usually attributed to the earlier Egyptian or Pharaonic dynasties, were in reality much more recent, being erected during the Ptolemaic and Roman rule in Egypt; which gave rise to some observations by Mr. Hamilton and Sir Gardner Wilkinson, who were present.

A paper was also read, entitled,

"*Remarks on the question raised by Sir Gardnor Wilkinson respecting the origin of the Vertical Line in Architecture, and the Return to the Horizontal Line after the* "*Revival.*" By George Godwin, jun., F.R.S. & S.A.*

At a recent meeting of the Institute of Architects, Sir Gardnor Wilkinson laid before the members some pertinent remarks, concerning the appearance of the vertical line in architecture at an earlier period than is generally ascribed to its introduction—remarks which, while they prove the acuteness of his observation, and cannot but lead to the exercise of thought on the part of those who are engaged in the study of architectural history, serve as evidence of the writer's interest in our proceedings, and entitle him to our thanks. I should be sorry, then, if they were allowed to pass unnoticed, and am tempted, in order that this may not be the case, to offer at once a few observations on the subject. I feel some diffidence, I must confess, in coming before you on this occasion, because there are many others present much better qualified to respond satisfactorily to the inquiry; indeed, I should not have done so, could I have been certain that any individual would have offered himself for the task. Experience, however, teaching that the only certain way to have one's wants and wishes fulfilled, is to bestir oneself in carrying them out personally, I have stepped into the breach, and must plead the goodness of the intention as an excuse.

The bearing of Sir Gardnor Wilkinson's general argument was to the effect that the vertical line, admitted to be the principal feature distinguishing Gothic, or what has been termed *Church Architecture* from the Greek style, whereof the predominance of horizontal lines is a characteristic—originated at a much earlier date than the style it now distinguishes, and is to be found extensively in the ruins of ancient Rome. Further, that after the revival of the classic style in Italy, although the vertical line was still used throughout the *churches* of Christian Rome, we do not perceive it in the numerous and splendid palazzi which arose there and in other parts of Italy, but that the horizontal line is in them again made predominant. And the question he then put was, "what was the origin of the vertical style in ancient Rome, and the return to the horizontal style in the palaces of modern Italy."

What Sir Gardnor Wilkinson means by the vertical line in ancient Rome, and the appearance which it offered, are very clearly pointed out in the following sentence extracted from his paper:—

"In an arch of triumph, a Roman composition, though the mouldings and many other details are borrowed from the Greek, the vertical line commences with the pedestal of the columns appended to its side, and extending upwards with the column, breaks through the entablature, which it obliges to come forward to carry out and mark its direction, requires a projection of the attic to correspond with the capital above the cornice, and terminates in a statue: thus continuing it uninterruptedly from the base to the summit of the building."

Now it appears to me, that this mode of arrangement may be ascribed simply to the introduction of the ARCH as a chief feature in construction, and the decline, if not original want, of pure taste on the part of the Roman people. In Greece, and in the earlier sacred edifices of Rome, built before the introduction of the arch, and in imitation of those of Greece, columns bore the beams of wood or blocks of stone forming the upper part of the building, and were a constituent portion of the fabric. When, however, it became necessary to cover in larger spaces than could be conveniently spanned by single beams or blocks reaching from pillar to pillar, and the principle of the arch became generally understood and acted upon, a continued wall from which the arch might spring became requisite, and took the place of columns. The Romans, however, who, if I may venture to say it, had little real appreciation of harmony and fitness, (with a love of which the Greeks as a people were thoroughly imbued,) could not consent to abandon columns, but used them in the shape of accessories in nearly all structures the destination of which would allow of their introduction. They were placed against the faces of buildings—attached to but not made a portion of them. Probably where a great projection was not advisable, the height of the columns (as by that of course the diameter must have been regulated,) was lessened, and a pedestal (*column's foot*) was used to raise them to the required elevation. Something to bind the upper part of the column to the building was, however, requisite, and the entablature, then surrounding the structure itself, may have been brought out for that purpose over each of the columns. These, of themselves, namely columns bearing nothing, performing no office, but simply standing before a building with which they seemed to have little connexion, must have failed to give pleasure even to the least educated minds; offering, however, as they did, a convenient plinth for vases, or sculptured figures, these were found in some degree to lessen the objection, and therefore it is not surprising that they were usually thus terminated, sometimes with and sometimes without, the intervention of a similar projection of the attic under the figure.

In examining a Roman arch of triumph, that of Septimus Severus for instance, as well as many others, the probability of this position becomes very striking. And throughout the buildings of Rome so long as columnar decorations were employed, this mode of arrangement seems to have been almost necessarily followed.

Sir Gardnor Wilkinson says that wherever deviation from Greek models was allowable, the vertical line constantly predominates, "and to such an extent, that even a Greek entablature is sacrificed to this their favourite sentiment, being broken up into detached parts and compelled to project and recede, in order to allow the vertical line to pass continuously through it to the summit of the building."

This seems to me, but I mention it with great deference, to invest the use of the vertical line by the Romans with a little too much importance. I am compelled to think, a desire for its use was not the cause of the introduction of breaks and recesses, but that its own appearance, as well as these breaks, were the accidental effect of the employment of adventitious columnar decoration in situations where considerations of expense or convenience prevented the use of a continuous entablature. Although it is probable that when once the vertical line was strongly marked in a façade, the natural love of harmony in mind which finds annoyance in the constant recurrence of discordant lines, would induce subsequent arrangements in unison with the prevailing character.

Immediately on the *revival*, we find columnar decoration indulged in, even with less restraint from good taste than before, producing in nearly all cases, whether in Italy, France, or England, the predominance of the vertical line. The cupola of the church of *Santa Maria del Fiore*, at Florence, by Brunelleschi, and the church dedicated to St. Francis at Rimini, by Alberti, both in the 15th century—the Basilica of Vicenza by Palladio, in the 16th—the principal façade of St. Peter's at Rome, by Maderno, at the beginning of the 17th—and the hospital of the *Invalides* in Paris, by Mansart, in the 18th—may all be referred to as instances. In our own metropolis, Inigo Jones, at the Banquetting House, Whitehall, and Wren at St. Paul's Cathedral, afford us examples: and to bring the duration of this mode of arrangement up to the present time, I may mention Messrs. Cockerell and Richardson's design for the Exchange, submitted to the Gresham Committee, in the chief front of which it strikingly prevails.

Returning, however, for a moment to Italy at the period of the revival, we find that works of the same artists wherein adventitious columnar decoration was not introduced, display the horizontal line predominant, witness for example the façade of the Pitti Palace at Florence, by Brunelleschi, and the greater number of the numerous palatial residences at Rome and elsewhere, which render Italy as eminent for the possession of modern works of architectural skill as she is for the remains of her ancient glories. This predominance of the horizontal line however was not quite universal. In the Palace of the Chancery at Rome, for example, the vertical line is nearly continuous throughout the façade, although the entablature is unbroken. I will not pretend now to enter upon an examination of the feeling and motive of the architecture of this period, although it is a subject full of interest, and well worthy of what it has not yet sufficiently received, namely, investigation and analysis: should what has been said chance to lead to this very desirable result on the part of a qualified investigator, the profession will be greatly indebted to Sir Gardnor Wilkinson.

New Mouth of the Vistula.—In consequence of the early breaking up of the ice in the Vistula, and the flood occasioned by the late heavy rains, the river was choked up a mile and a half above the city of Dantzic, whence it takes its course to the westward. The left bank of the river is here bounded by a dyke, which protects the fruitful low country behind it; the right bank is, however, without any such artificial protection, because its immediate neighbourhood consists of unfruitful sand land, and of a road of sand-hills or downs, for a distance of several German miles, which separates the river from the sea in such a decided manner, that it never appeared possible to any one that from that side any danger was to be apprehended from the water in the Vistula. But it happened on the night of the 31st of January, when it was expected that every moment the water would run over the dykes on the left bank of the river, and produce a most dreadful inundation, that the stream, encumbered with heavy masses of ice, took its course over the right bank, and attained the sand hills. These being from forty to sixty feet high, stopped the water, but the current undermined them just at the place where those hills merely consist of loose sand, and are the narrowest. As soon as they gave way, the accumulated mass of water and the heavy ice found their way through this new opening with indescribable force, and made a broad and deep channel into the sea. To stop this new natural mouth is impossible, and if it could be done, no one would feel inclined to do it. About thirty years ago, the plan was proposed by members of the government to form exactly the new mouth for the river which has just been made by a natural cause. Thus a great expence has been saved, and a great benefit operated at the same time, by this occurrence. As regards the influence which this event may have on the communication of the town of Dantzic with the Port Fairwater, and also with Poland and the interior of the country, there is not the least ground to apprehend any interruption. We by no means lose the navigableness of the old Vistula, which, henceforward as before, will bring the Polish barges and the timber transports to our town. Its depth is likewise sufficient in its whole length to bear vessels of the same magnitude as before. Neither does the occurrence make any change whatever in the communication of that town with the sea-port.—*Morning Chronicle.*

---

* We are glad to learn that the *Société Libre des Beaux Arts*, at their last annual meeting, awarded a silver medal to Mr. Godwin, as author of "The Churches of London."—EDITOR OF C. E. & A. JOURNAL.

EARL DE GREY'S CONVERZATIONE.

On Thursday evening the 21st ult., Earl De Grey opened his house in St. James's Square, for the reception of the Royal Institute of British Architects, of which Society his Lordship is the President. In addition to the members of the Institute, the splendid suite of apartments was crowded by a numerous and brilliant assembly of the patrons and professors of every branch of the arts and sciences, among whom we noticed the Marquis of Lansdowne, Lord Stuart de Rothesay, Lord Bughersh, Sir Edward Cust, Mr. Gally Knight, and Mr. Rogers, Sir Martin Shee, Sir Richard Westmacott, Sir Francis Chantry, Sir David Wilkie, Mr. Martin, Mr. Copley Fielding, Sir Gardner Wilkinson, Sir Henry Ellis, Sir Frederick Madden, Mr. Walker, Mr. Brunel, Mr. Babbage, Mr. Allan Cunningham, &c. &c. Her Grace the Duchess of Northumberland and a select party of ladies of rank were also present. The attention of the visitors was attracted by a display of works of art from the portfolios of Mr. Stanfield, Mr. Joseph Nash, and other artists of eminence, and by some beautiful specimens of the Daguerrotype and electrotype.

MR. WALKER'S CONVERZATIONE.

On Wednesday evening the 27th ultimo, Mr. Walker, the President of the Institution of Civil Engineers, invited a large number of scientific gentlemen to a converzationé held at his house in Great George-street, the rooms were crowded at an early hour of the evening, we have not witnessed so large an assembly of the scientific and literati during the season. The company were entertained by a display of numerous works of art, drawings and models of new inventions, a few of which we shall just take a glance at. The portfolios of drawings by Scannell, Tomkins, Landseer, and Lake Price were much admired, so also the elaborate work on the Alhambra by Owen Jones. There was exhibited an excellent specimen of electrotype taken from an engraving of Byron, the original engraving was shown from which the electrotype was produced, the first is in relief, and for the purpose of taking off impressions, a second electrotype is obliged to be taken off from the first, which brings this last impression to the same appearance as the original plate; there were also shown two impressions, one taken from the original plate, and the other from the second electrotype, both of them were so much alike, that it was with difficulty any difference could be detected.—There was a fine representation in stained glass of Mary Queen of Scots and Knox, by Messrs. Hoadley and Oldfield.—In the model room was exhibited a beautiful set of 8 models of Mr. Brunel's block machinery at Portsmouth, showing the different operations the block passed through from the square block of wood to its completion.—Mr. Rennie's trapeziod paddle-wheel attracted considerable notice, likewise the beautiful models of Mr. Samuel Seaward's marine atmospheric steam-engines, also his slide valves by which the eduction valve is opened before the induction valve, thereby allowing a better and more rapid escape of the steam to the condenser, and producing a better vacuum; his brine detector which exhibits the quantity of salt with which water in marine boilers is impregnated, is of great advantage to the engineer, by the aid of which he is enabled to judge the proper times it is necessary to *blow off*, for the purpose of cleansing the boilers of the salts which are deposited at the bottom, which if not attended to, very soon destroys the metal.—Another very ingenious model was that of Mr. Davison's refrigerator, lately constructed at Messrs. Truman's brewery, a vertical cylinder which contains several tubes, is filled with a stream of cold water, constantly flowing through it, which surrounds the tubes; there is also a blast of cold air forced through the interior of the tubes by the aid of a fan blower—the hot liquor is admitted into an open chamber on the top of the cylinder and allowed to gradually overflow the tubes which project above the bottom of the open chamber, and trickle down the interior side of the tubes, thus it is cooled by the combined operation of cold water coming in contact with the outside of the tubes, and the cold blast up the centre of their interior, by the time the hot liquor has arrived at the bottom, it is sufficiently cooled to be conveyed into the working tuns.—There was a model of Messrs. Maudslays and Field's double cylinder steam-engine, described in a late number of the Journal.—Mr. Milne's hydrostatic gas regulator, by the aid of which the lights are always kept at one height and intensity.—The patent omnibus, if we may judge correctly by the model, appears to be a cumbersome machine, and likely to monopolize the whole of the streets in the city, if many are to be introduced.—There were likewise several models of machines and apparatus connected with railways and steam navigation, by Mr. Curtis, Mr. Cottam, Mr. England, Mr. Greener, and others.—A very neat letter balance by Professor Willis attracted notice.—Some specimens of drawing paper made by Mr. Ranson's patent machinery were exhibited, by which drawing paper may be had in unlimited lengths and in any width up to 4 feet, and also of any degree of fineness or quality.—Mr. Bielefeld's Papier-Mâché ornaments, particularly a Corinthian capital, were objects worthy of notice.—Some specimens of bricks and tiles, made by Bakewell's press, showed the superiority of bricks made by this machine over those of the ordinary kind. Besides what we have already enumerated, there were objects of considerable interest distributed through all the rooms, not forgetting the beautiful models and drawings of works in progress under the directions of Mr. Walker in all parts of the kingdom.

We can truly say that we never saw a party more satisfied than the one of this evening, with the judicious combination of social and scientific arrangements, and the select, yet abundant materials for intellectual, as well as hospitable entertainment provided by the worthy President.

Among the numerous distinguished individuals present, we recognized Earl de Grey, the President of the Institute of British Architects, Lord Western, Lord Lowther, Lord Blayntyre, Sir Robert Peel, Sir Henry Parnel, Sir John Rennie, Sir Duncan M'Dougal, Sir John Rae Reid, Sir George Murray, Sir John Scott Lillie, Sir W. Pearson, Sir H. Ellis, Sir W. Burnett, Sir W. Riddell, Sir James Duke, Sir Hesketh Fleetwood, Sir John Barrow, Sir David Wilkie, Sir Peter Laurie, Mr. Hodges, M.P., Mr. Handley, M.P., Mr. Baines, M.P., Mr. Pease, M.P., Professor Willis, Mr. Babbage, Major Anderson, Col. Colby, Col. Paisley, Col. Thompson, Dr. Reid. Dr. Field, Dr. Roget, Sergeants Spankie and Adams, Mr. Barry, Mr. Tite, Mr. Hardwicke, Mr. Blore, Mr. Basevi, Mr. Donaldson, Mr. Fowler, Mr. Kendall, Mr, Stephanoff, Mr. Landseer, Mr. Stone, and a great number of architects, artists, and most of the members of the Institution of Civil Engineers.

NOTES OF THE MONTH.

The Royal Exchange competition has been decided in favour of Mr. Tite, so that we suppose the works will now go on. Mr. Cockerell his competitor is exhibiting a model of his design in the Old Jewry.—Mr. Barry, as if he were not satisfied with providing for the legislature, has now been engaged in making designs for the new Courts of Law, proposed to be erected in the square of Lincoln's Inn Fields, the expenses to be mainly defrayed from the Suitor's Fund. This plan has received the approbation of the lawyers, and will doubtless be carried into effect, giving the architect the opportunity of adding another colossal building to the architectural contributions of the Victoria era.—The area in Trafalgar-square is now a scene of activity, the footpath which connects the Strand with Cockspur-street, has been brought considerably nearer to the Whitehall side, thus adding a large space to the former enclosure, which we trust will be laid out so as to agree in character with the National Gallery, to which it might be made to give a greater appearance of elevation.—A diminished grant has been taken for the buildings of the British Museum, so that they must linger on in the old style.

In addition to the information which we conveyed last month about the Daguerreotype, we may mention that the attempt to produce permanent engravings so as to admit of impressions being taken, has perfectly succeeded.

Among the men of science, whose loss we have sustained may be mentioned Poisson, the eminent French mathematician, and Sir Robert Seppings.—Sir Robert was surveyor to the navy for nearly fifty years, during which time he was the means of introducing many improvements into the navy, worthy of his own invention, as the circular bow and stern, the system of diagonal bracing, of scarfing short pieces, of making frigate timber applicable to line of battle ships, and the use of the iron knees.—Mr. Whitwell, the architect of the unfortunate Brunswick Theatre, also died recently, but as we hope to attain some particulars respecting him, we shall defer any farther notice of his services.—We may mention among the professional losses, and as a very severe one, the unfortunate destruction of a great part of York Minster by fire, arising from carelessness. We feel pretty sure however that this national monument will be restored.

Durability of Iron Boats.—The question of the durability of iron vessels, of their little liability to accident, and of the ease with which damage done to them may be repaired, appears to be very clearly proved from the experience which has already been obtained on these points; and this is no little, for there are boats built by Mr. Laird in both North and South America—in all parts of India and on the Euphrates and the Indus—in Egypt, on the Nile—and in the Mediterranean—on the Vistula, on the Shannon, and on the Thames. One of these boats on the Savannah has been constantly at work for these last six years without any repair; which is a great test, if we consider the frequent constant caulkings required to preserve a timber-built ship. There is also a steam-yacht built of iron, the Glow-worm, the property of Asheton Smith, Esq. This vessel has made the passage from Bristol to Carnarvon, a distance of 210 miles, in 18 hours. In the report to the House of Commons on steam-vessel accidents, we find the following stated of the Garryowen, one of these vessels:—"We went ashore about two cables' length to the eastward of the pier (Kilrush), and struck very heavy for the first hour. The ground under our weather-bilge was rather soft clay, covered with shingle and loose stones, some of them pretty large. Under our inside, or lee-bilge, the ground was very hard, being a footpath at low water. I was greatly afraid she would be very much injured by it in her bottom, but I am happy to say she has not received any injury; in fact, her bottom is as perfect and as good as on the day she left Liverpool—not a single rivet started, nor a rivet-head flown off. If an oak vessel, with the cargo I had on deck, was to go on shore where the Garryowen did, and get such a hammering, they would have a different story to tell. * * Out of 27 vessels that got ashore that night, the Garryowen is the only one that is not damaged more or less." Colonel Chesney, the commander of the Euphrates expedition, writes thus of the iron vessels which were employed on that service:—"It is but right to tell you that the iron vessels constructed by you far exceeded my expectations, as well as those of the naval officers employed in the late expedition, who would one and all bear testimony anywhere to their extraordinary solidity; indeed, it was often repeated by Lieut. Cleveland, and the others, that any wooden vessel must have been destroyed before the service was one-half completed, whereas the Euphrates was as perfect when they laid her up at Bagdad as the first day she was floated.—*Mr. Cruise, United Service Journal for May.*

QUERIES.

A correspondent is desirous of having some comparison between Sneeze Wood, Right Yellow Wood and Els, and those in use with us, such as Fir, Oak, &c. The woods alluded to may be found in 3rd Vol. Royal Engineers, "Bridge across the River Kat." A. P.

STEAM NAVIGATION.

Oscillating Marine Engines.—This description of engine is daily becoming more generally known and adopted; their great advantage is the extreme lightness and the small space they occupy in a vessel; in both these important particulars the saving is nearly one-half. For vessels of limited draft or for shallow water, they must ultimately become in general use. During the last month we attended the trials of two new steam-vessels, fitted with oscillating engines manufactured by Messrs. Penn & Son, of Greenwich, who have devoted to this class of engine considerable attention, and have fitted up no less than 17 pairs of them; they have not been known to fail in a single instance, and are the admiration of all parties who have witnessed their performance, for the beauty of the workmanship, and the accuracy with which they work, particularly those on board the iron steamers plying on the River Thames above bridge. Messrs. Penn have always found this description of engine give a result fully equal to their dimensions, in comparison with others of the ordinary construction. The first vessel whose performance we witnessed last month was the *Courier*, an iron steamer, built by Messrs. Ditchburn & Mare, of Blackwall, intended to run on the Elbe between Hamburgh and Magdeburgh, 158 feet long at the water line, and 20 feet beam; draught of water, with engines, boilers filled with water, and 15 tons of coke, is only 19 inches in midships, and 14 inches at stem and stern. The engines have cylinders 34 inches diameter, with a 3 feet stroke, and make 27 strokes per minute, and are estimated at 32 horses power each. The weight of engines and boilers filled with water is 37 tons 15 cwt. The paddle-wheels are 15 feet diameter, with float-boards 8 feet long and $13\frac{3}{4}$ inches wide. The second vessel whose performance we witnessed was the *Queen Victoria*, a new timber-built vessel, constructed by Mr. Thompson, of Rotherhithe. She is 90 ft. long, 13 ft. 9 in. beam, and 2 ft. 9 in. draught of water, fitted with a pair of oscillating engines of 15 horses power each; the weight of the engines with boiler filled with water is only 15 tons, being 10 cwt. to the horse power; the total length of engine-room is 19 ft. 6 in. The speed of this vessel is very little inferior to the Gravesend boats, and is by far the fastest of her power ever produced. She ran the mile at Long Reach, with the tide, in 4 minutes and 50 seconds, and against the tide in 6 minutes 36 seconds, giving an average speed of $10\frac{3}{4}$ miles per hour. This boat is intended to run between Hungerford and Woolwich.

Race between the "Ruby" Gravesend steamer (oak built), and the "Orwell" and "Sons of the Thames" iron steamers.

Sir—As there has been of late much attention drawn to the subject of iron steam vessels, which are announced as possessing great advantage over those of wood, and as I have perceived various notices of the progress of different vessels of this class in your Journal, I shall feel obliged by your giving insertion to the following account of a run which took place on Saturday, May 2nd, between the Ruby, and two of the crack iron steamers.

I should premise that the Ruby has now commenced running for the fourth season, and that no vessel has yet been found that can compete with her. She is timber-built of English oak plank, upon the improved diagonal plan adopted by the Diamond and Woolwich Companies—a plan I have no hesitation in saying is stronger, more durable, and superior to that of any combination of iron whatever. She has never been caulked since the day she was launched, nor a farthing laid out in repairs, and her lines are as true as when they were first laid down on the shipwright's floor.

As the Ruby has been lying by some time to refit for the season, the owners of the two iron boats alluded to, took the opportunity of announcing their respective craft as the fastest vessels in the kingdom, but the Ruby has again taken her place as number one, and like a giant refreshed with sleep, goes better and faster than ever, and the victory she has achieved over the Orwell and Sons of the Thames will no doubt cause their respective partisans to alter their tone for the future.

Your's, &c. A. Billings,
Manager of the Diamond Steam-boat Company.

Race between the "Ruby" and the "Orwell."—1st Trial. On Saturday, at 8 p. m., the Ruby got under weigh from Blackwall, and proceeded slowly down the river, to enable the Orwell to come up, as she was to start from London at eight o'clock. The Ruby went half speed down to Long Reach, no "Orwell" in sight, then tried the mile one hour after flood, spring tide, came back as far as the Halfway House, and discovered the Orwell coming down with plenty of smoke and steam; turned round the Ruby, and went on quarter speed till the Orwell was just four boats astern at Erith, off Cold Harbour Point. Set off full speed, with strong flood tide, two hours flood, (the reasen of placing the Ruby ahead was the fear of hugging, as both were near the shore). The Ruby's engines went off in fine style,—31 strokes, and she soon began to draw away perceptibly from the Orwell, (the Orwell's people at this time hoisted the jack at the main;) however, when off Purfleet the Ruby had gained a quarter of a mile upon the latter vessel, the jack was hauled down, and the Ruby, as the conqueror, hoisted hers, the Ruby gradually gained upon her antagonist, till she stopped at Gravesend Town Pier, when, by observations made, the Orwell was $1\frac{1}{2}$ miles astern, and by time 8 minutes as she passed the Town Pier, thus beating the Orwell in a run of 14 miles about $1\frac{1}{2}$ miles, the distance of four boats length to be deducted, which was the distance the Ruby was ahead when the race began. The Ruby ran the whole distance against a strong flood tide and ahead, in one hour and ten minutes, being seven minutes less time than the Orwell.

Second trial from Gravesend.—The Ruby having stopped ten minutes at Gravesend Town Pier, allowed the Orwell time to come up on the opposite shore and pass Tilbury Fort, when she again started for the chace, and by the time the Ruby had crossed the river against the strong flood in the stream, the Orwell was one mile ahead. The Ruby then ran on for forty-five minutes, in which time she caught the Orwell, and went right by her neck and neck, (you might have tossed a biscuit from one vessel to the other,) headed her by a quarter of a mile, turned round and was back to Gravesend in seventy minutes. In this second race she beat the Orwell one mile in 45 minutes; from the above it will appear that the Ruby, against tide, is full $1\frac{1}{2}$ miles per hour faster than her antagonist.

Race with the "Sons of the Thames."—The Ruby waited at Gravesend till 4 o'clock, and then started up the river to meet the Sons of the Thames. The latter vessel and the Mercury left London at 5 p. m., and at 40 minutes past five they were both discerned at the bottom of Woolwich Reach, the Sons of the Thames full a quarter of a mile ahead of the Mercury. Some colliers being in the stream prevented the Ruby being turned round so soon as she ought to have been, so that when the vessel was got round with her head down, the Sons of the Thames was a quarter of a mile ahead, and the Mercury was just alongside, all three going full speed, and the tide running down strong. It was now evident by the Ruby drawing away from the Mercury, that she was gaining fast upon the Sons of the Thames, which vessel the Ruby came up to in 15 minutes, when the Sons of the Thames had a half minute stop, and the Ruby shot by her, and continued to gain upon her till the arrival at Gravesend Town Pier, when the Ruby was one mile ahead. It should be observed that at Greenhithe, the Sons of the Thames had another short stop, but as she was going all the time with the tide, both these stoppages could not have made more than one minute's difference. The whole distance was done by the Ruby, from the bottom of Woolwich Reach in 55 minutes.

General Remarks.—It is right to observe, that during the above races, the Orwell apparently had 100 persons on board, and the Sons of the Thames about 50, whilst the Ruby had none but her crew. To some this may appear an advantage for the Ruby, but the advantage would have been more i favour of the Ruby if she had had 200 persons on board, as her paddles would then have had more hold of the water, and the vessel would have consequently gone faster; as during the race the Ruby's engines were overrunning their speed for want of proper resistance to the wheels. The Ruby's best speed is when she has 300 persons on board; in proof of which, the Ruby started from Gravesend on Sunday night last, with 300 passengers on board, half an hour after the Sons of the Thames had left, and arrived at London Bridge within three minutes of the time that the latter reached there, the Ruby thus beating the Sons of the Thames 27 minutes in the whole distance, which was entirely against a strong ebb tide. A. B.

The "Elbe" Steamer.—The "Elbe" steamer, which arrived lately from Dunkirk, for the purpose of getting her machinery put on board by Mr. Borrie, of the Tay Foundry, made a trial trip, on Saturday 2nd ult., to prove the efficiency of her engines. She left the West Protection Wall at one o'clock p. m., with about sixty-five of Mr. Borrie's friends on board, for whom he had prepared ample cheer. She proceeded down the river,—rounded the Bell Rock,—run to the Buoy of Tay in fifty-five minutes, being a distance of 12 miles; and from the Bell Rock to the Harbour in two hours and a quarter—a distance of 24 miles—having the ebb tide against her in coming up the river. The vessel was built by Mr. Malo, of Dunkirk, and it was the general impression on board that both the builder and engineer had performed their parts well, and had, between them, furnished a very superior steamer—a fact of which, indeed, they were then witnessing the proofs. The engines (of 160 horse power) were much admired by several professional gentlemen on board for smoothness of action, their elegant and substantial construction, and high finish. The "Elbe" is about 500 tons burden, and belongs to the Dunkirk and Hamburgh Steam Navigation Company. She will shortly join "The Nord"—(fitted out in the early part of last season by Mr. Borrie)—on the Dunkirk and Hamburgh station.—The great increase in the trade of building and fitting up steam ships at Dundee, has rendered the starting of marine engines, at one time a rare, now a very common occurrence amongst us; and—not unmindful of the merits of Mr. Borrie's brother engineers in this place—we have much pleasure in stating that both they and he, from their profound knowledge, great experience, and integrity in fulfilling their engagements in the best and most satisfactory manner, do honour to their profession and to Dundee. On the present occasion, we are specially glad to bear testimony to the steady advancement of Mr. Borrie's well-earned reputation in every department of engineering; and to notice the gratifying fact, that his eminence as a marine engineer has now attracted the attention of Government. The great crane, erected by Mr. Borrie last season, according to the designs of James Leslie, Esq., engineer of the harbour, affords, in connection with our spacious docks, facilities equal, if not superior, to any in Great Britain, for the fitting up of the largest class steamers; and we are happy to learn that Mr. Borrie will, in all probability, be the first to profit by his own labours and enterprise at the port of Dundee.—*Dundee Chronicle.*

TRANSATLANTIC STEAMERS.

Comparison of the passages of the four lines of Sailing Packet Ships between Liverpool and New York, with those of the Transatlantic Steam Ships, during the year 1839.

Sailing Ships.	Longest Outward.	Shortest Outward.	Average Outward.	Longest Homeward.	Shortest Homeward.	Average Homeward.
	Days.	Days.	Days.	Days.	Days.	Days.
Old or Black Ball Line ..	48 0	22 0	33 17	36 0	18 0	22 12
Dramatic Line..........	38 0	23 0	30 12	25 0	17 0	20 12
Star Line..............	45 0	27 0	36 0	28 0	21 0	24 0
Swallow-tail Line	45 0	28 0	35 0	31 0	17 0	22 12
Steam Ships.						
Great Western..........	21 12	13 0	16 12	15 0	12 6	13 9
British Queen	20 9	14 21	17 8	21 12	13 12	16 12
Liverpool..............	18 12	16 0	17 4	27 0	13 18	15 16
Average of all the Sailing Ships	44 0	25 0	34 1¼	30 0	18 6	22 1
Average of all the Steam Ships	20 3	14 15	17 0	21 4	13 4	15 4¼
Difference in favour of the Steam Ships	23 21	10 9	17 1¼	8 20	5 2	7 13¼

The immense superiority, in point of speed, of the Steam Ships, will be fully evident on inspection of the above table; where the difference in the first instance is more than half; in the second almost three-fifths; in the third more than half; in the fourth more than a quarter; in the fifth near a third; and in the sixth more than a third.

It must, however, be borne in mind that the Transatlantic Steam Ships are yet in their infancy, whilst the sailing ships are perfection; there being no faster ships on the face of the globe than the New York and Liverpool Liners.

Steam Navigation in Germany.—Besides the generally good roads, steamboats and railway lines are, of late, facilitating interior communication in most parts of Germany. Everybody in England knows the steam-boat communications on the Rhine, which for several years past have poured out a mighty stream of English travellers along the western parts of Germany and Switzerland. In the course of this summer, (1840,) the banks of the Elbe, Saxony, Bohemia, and the whole central part of Germany, will be as easily admissible to the tourist, as the banks of the Rhine have hitherto been. Perhaps a few words on this subject may prove acceptable to persons intending to take a trip or a journey to countries comparatively not so generally known. From London or Hull to Hamburgh steam-boats are regularly running several times every week. Hamburgh is situated about eighty miles inland, on the navigable Elbe. From Hamburgh to Magdeburgh, the journey is performed on board steam-boats, offering the best accommodations. The distance, by the river, is about 250 English miles. From Magdeburgh to Leipsic a railway is constructing; it will be opened in its whole length, in the early part of this summer: the journey—about seventy-four miles—will then be performed in three or four hours. From Leipsic to Dresden a railway has been in operation for more than a year: the distance—seventy-one miles and a quarter—is performed in about 3½ hours. From Dresden another line of steam-boats run, about fifty miles, as far as Tetschen, in Bohemia, where you find yourself at a few hours' journey from Prague and Tœplitz, as well as in the vicinity of Carlsbad, Frezonsbad, and the other celebrated and fashionable Bohemian watering places, which may all all now be reached without any fatigue, or any great expense, five days after embarking from England. From Prague to Brün the distance is about sixty miles, where the traveller will find excellent public coaches, or can take for private use, at any time and at moderate prices, stage-coaches, kept always in readiness by all the post-administrations throughout the Austrian Empire, for the accommodation of families travelling without their own carriages. From Brün to Vienna, the journey—about eighty-five miles—is performed in four or five hours, by a railway which has been in operation for upwards of a year. From Vienna the steam-boats on the Danube run through Hungary to the Turkish frontiers, and the Black Sea, in communication with those plying to Constantinople, Odessa, Trebizonde, &c. In two months, when the whole Magdeburgh-Leipsic Railway is opened, a person may travel from England to Vienna, or to Constantinople by steam, with the exception of a distance of about eighty miles, comprising the two sections of road from Tetschen to Prague, and from Prague to Brün, where neither railway nor steam-boat conveyance is as yet established.—*Athenæum.*

PROGRESS OF RAILWAYS.

Bristol and Exeter Railway.—It is expected that a portion of the Bristol and Exeter Railway, as far as Bridgewater, will be opened in the course of the present year. We understand that the works are proceeding with great activity.—*Railway Times.*

BLACKWALL RAILWAY.

Considerable exertions are being made to open that part of the railway from the Minories to Blackwall on the 18th inst., the anniversary of the battle of Waterloo, when it is expected that his Grace the Duke of Wellington will be present; one line of railway is nearly completed from end to end, *the railway* is carried on a viaduct from the Minories to the West India Docks, thence it is continued on an embankment, until it immerges into a shallow cutting near the terminus at Brunswick Wharf, and terminates under a shed covered with an iron roof, similar to that of the terminus of the London and Birmingham Railway at Euston-square; adjoining the shed is a spacious building for the offices, of the Italian style of architecture, and forms a prominent feature from the river, it is erected from the designs of Mr. Tite the architect, President of the Architectural Society; the Blackwall terminus is most conveniently adapted for steam-boats, being situated on Brunswick Wharf, alongside which the largest class steamers can embark and disembark passengers at all times of the tide, and there are already 2 Gravesend steamers announced for starting from this spot as soon as the railway is opened, and no doubt many others will follow; it is more than probable, before another year passes over, all the steamers which now start from below bridge will make the Blackwall terminus the starting place, thereby avoiding the most dangerous part of the voyage through the Pool, and save in time about three quarters of an hour; by this means the Gravesend boats will be able to make two trips each way every day, and we have no doubt it will also be found the most advantageous route to Woolwich, which can be done by railway, and steamers across the river within three quarters of an hour from the Minories to Woolwich.

To afford every facility for the conveyance of passengers, two classes of carriages have been provided, part of which are already delivered; the first class are enclosed, painted blue, finished very tastefully, and emblazoned with the Arms of the City, and the East and West India Dock Companies, at the same time there is no superfluous ornament or extravagance about them—the second class carriages are open at the sides, and are not provided with seats; the passengers will be obliged to stand during the short time that they are being conveyed, which it is expected will be in about nine or ten minutes; it is stated that the fares will be very trifling, for the first class carriages 6*d*., and the second class 4*d*.

The breadth of the viaduct on the top is 24 feet in clear of the coping stone or cornice, and 28 feet out and out. The arches on the top are covered with asphalte to prevent the percolation of wet through the brickwork. The rails are light in consequence of being relieved of the heavy locomotive, the form is T shaped, and 5 inches deep, they are laid to a 5 feet 1 inch gauge, on transverse sleepers of English fir, 3 feet apart, upon which the chairs are spiked—the rail is secured to the chair in rather a novel manner, a hole is pierced through one of the arms of the chair at right angles to the rail, in which an iron ball about the size of a bullet is dropped and rests against the rail, an iron key or wedge is then driven through an aperture in the same arm of the chair parallel to the rail, which fixes and presses the ball firmly against the latter, this method of fixing prevents any lateral vibration of the rail, and at the same time it allows the free expansion and contraction of the metal. Down the centre of each railway are fixed the pulleys upon which the tail ropes will traverse, placed 30 feet apart; they are 30 inches diameter, and 8 inches wide across the sheave, the rim is lined with rope matting to prevent any noise from the rapid motion of the rope passing over them; the axles turn upon plummer blocks fixed on an iron curb, and over each bearing is a small box for grease to lubricate the axles; the pulleys are fixed vertically throughout the line, both in the straight part and the curves, for the latter they are of a different shape to the others, being 30 inches diameter on one side, and 36 inches on the other; the rim is formed like the outside of the mouth of a large bell.—In the last month's *Journal*, p. 178, is described how the railway is to be worked, by what is technically termed tail ropes, that is, a rope at each terminus is attached to the carriages, and as the rope is coiled up at one end of the railway by the aid of steam-engines, it draws the carriages, and at the same time the rope at the other end is being unwound, thus by the time the forward rope, with the carriage, is wound up at the station at Blackwall, the rope of the station at the Minories is unwound, it is then ready to draw the carriages from the Blackwall terminus back to the Minories. For this purpose there are four of these ropes, two to each line—they are each 3½ miles long, and 5¾ inches diameter, and are worked by two pairs of marine engines at each end of the line, those at the Blackwall terminus are 70 horses power each engine, manufactured by Mr. Barnes, and at the Minories station each engine is 112 horses power, manufactured by Messrs. Maudslays and Field, the latter are of greater power than the former, in consequence of the railway being principally upon the ascent from Blackwall to the Minories; each rope is worked by one pair of engines, the power is tranferred from the engines by means of spur wheels which turn an immense wheel or iron pulley 14 feet diameter in the clear, and 22 feet out and out, and 3 ft. 6 in. wide on the outer circumference, and about 21 inches at the inner circumference,—round this wheel is coiled the rope just described. The engines at the Minories station have each a marine boiler of large dimensions; and those of Blackwall, one pair have three Cornish oval boilers, and the other pair two marine boilers. The engine house at Blackwall is on a level with the railway, and at the Minories it is below the railway, under the arches. The whole of the works do considerable credit to the respective contractors, and to the indefatigable zeal of the engineers, Mr. George Stephenson and Mr. Bidder.

The North Midland Railway.

The North Midland Railway, which forms a communication between Leeds and Derby, was partially opened for traffic on Monday, 11th ult. On Saturday morning, preparatory to that opening, the Directors took a trip along the line, starting from Derby, and traversing to about within eleven miles from the terminus at Leeds. But, although the line is in a condition to be traversed from Derby to the immediate neighbourhood of Wakefield, the portion open to the public extends only from Derby to Rotherham, a distance of about 40 miles, giving, by means of the Sheffield and Rotherham Railway, an uninterrupted railway communication from Sheffield to Derby; from thence by the Midland Counties Railway to Nottingham and Leicester; and by the Birmingham and Derby Railway, to Birmingham and London.

The railway station at Derby is a wonderfully extensive place, which astonishes every person on arriving there for the first time. The length of buildings and covered way now erecting extend, we believe, 1050 feet. So stupendous and magnificent does every thing appear, that imagination almost leads passengers to suppose they are arrived at a market-place for steam engines. The buildings comprise a handsome hall, offices, refreshment and waiting rooms, with requisite conveniences, 230 feet long, 3 stories high, with a façade wall extending each way 410 feet, with openings for the departure of passengers on their arrival. The platform the whole length is formed by large Yorkshire stone landings of a superior quality. The passengers' shed extends the whole length of the walls and buildings, which is covered by a light iron roof of 42 feet span. The centre part of the passengers' shed is 56 feet span, and one bay 42 feet, are also covered, in the whole about 450 feet in length, and supported by handsome iron columns, 22 feet high from the top of the rails.

The arrangements for the lines of rails with the requisite number of turntables are on an extensive scale, and appear to be well adapted for the traffic and depôt for the Company's carriages.

In addition to these buildings there is an engine-house with 16 sides, 134 feet across, with a conical roof and lanthern rising to 54 feet above the floor from the top of the columns, which are 18 feet high; this building is approached by two wings 48 feet long, over which will be a reservoir of water for the supply of the engines, &c.

The preparations for the repairs of the Company's engines and carriages bear the same proportion, the shops averaging 160 feet long each, by 70 feet wide, three stories high, and smith's furnaces to each in connexion with other buildings.

When the extensive nature of these works is considered, and that they have only been 9 months in hand, the greatest praise is due to Mr. Jackson, the contractor, for the despatch employed, and the stability and beauty of these structures, which, in connexion with the other stations on the line, reflect the greatest credit on the taste and skill of Mr. Thompson, the Company's architect.—*Abridged from the Derby Reporter.*

Cheltenham and Great Western Union Railway. Engineer's Report, read at the last Half-Yearly Meeting on the 30th April.

Gentlemen—Notwithstanding the many causes of delay which have arisen, all the principal works between the Lansdowne Bridge, at Cheltenham, and the proposed station at Gloucester, have been completed. Two bridges, which are three-quarters finished, and about 20,000 yards of earthwork for the approaches to one of these, namely, the Badgeworth Road Bridge, together with the trimming and soiling of slopes at several places, are all that now remains to be done to complete the whole of this portion of the line, preparatory to the laying the ballast and the permanent way.

The excavation for the junction between the Birmingham and Gloucester Company's station at Cheltenham and the main line at Lansdowne Bridge, has been commenced, and upwards of 40,000 yards of ballast are prepared and set aside.

The cuttings and embankments upon this district, although consisting principally of clay, have not suffered much during the late wet season, and there is now every appearance of the works standing well.

The five permanent shafts of the Saperton Tunnel, referred to in the last Report, have been completed; the sixth, which will be the least in depth, and in other respects the easiest in construction, has not been commenced, in consequence of the taking possession of any land, at that part, involving, by the arrangements with the proprietor, the previous purchase of the whole of the land required for the works generally in the same parish, and which expense you deemed it unnecessary at present to incur.

Between Cirencester and the junction with the Great Western Railway at Swindon, the works have, generally speaking, been actively proceeded with during the last half-year.

Of the masonry of bridges and culverts, which is of course principally summer work, upwards of 3000 yards have been executed, and 7,500 remain unfinished, independently of the covered way, which contains about 5,300 yards and which is just commenced.

Of the 900,000 yards of earthwork, which, as was stated at the last meeting, then remained to be moved, 400,000 have been excavated, and formed into embankment; and there remain, consequently, 500,000 only, to complete the work.

Upon the whole extent of the works in this district, both the cuttings and embankments have stood remarkably well; the few and slight symptoms of slipping, which occurred on one single part only, have been entirely remedied, and the slopes are now in excellent condition.

Although the average performance, however, has thus, upon a total distance of 17 miles, been such as would, calculating at the same rate, and allowing but moderately for the great advantages of the summer season, ensure the completion of the whole during the next five or six months, this average rate has not been equally maintained upon all the contracts.

The works of the Cirencester branch to Kemble are in a forward state, and might easily be finished during the next August; and the contractor for that part of the line extending from the Great Western Railway to the Red Lion at Minety, a distance of upwards of nine miles, would be able to complet the work, including the laying of the permanent way, by the month of September. An embankment of about 160,000 yards, contract. No. 2, is th principal work to be executed on the remainder of the line; and if very grea exertions were used, there can be little doubt that the whole might b brought into profitable work with the commencement of the year 1841, o even by the end of the present year; while, in the mean time, the nine mile before referred to, forming part of a continuous line in conjunction with th Great Western Railway, might be brought into operation at a still earlie period.

The prospect of the early opening of the Great Western Railway, up to Swindon, which may be expected during the latter end of the present year, and the great state of forwardness of several miles at that extremity of you line, would render a successful effort highly valuable. These exertions would, of course, necessarily demand a proportionably rapid expenditure of the capital of the Company—an expenditure, however, which would be unquestionably economical in the end. I am, Gentlemen, your's obediently,

I. K. Brunel, Engineer.

Great Western Railway.—The works in the neighbourhood of Bath are proceeding with very great activity. The foundation of the pier in the centre of the Avon, near the Old Bridge, having been properly laid, operations have been commenced on the Widcombe side of the water. In the Ham gardens the erection of the arches on which the Bath depôt will be situated, is being rapidly proceeded with; whilst some steps have been taken towards erecting the viaduct across the Dolemead and Pulteney road. The tunnel at the top of Raby-place is likewise being finished in a very rapid manner. Towards Hampton the works are of a heavy character, and the utmost despatch is, therefore, observable in that quarter. The workmen have made great progress in the necessary excavations for turning the course of the canal immediately opposite the Cleveland Baths. The embankments for the permanent way are here in a forward state; while, near Hampton church, and in the meadows beyond, the contractors have been very active, and operations have been commenced throughout the extent of the line to Bathford. Altogether, there seems no reason why the line between Bath and Bristol should not be opened towards the close of this summer; and we hear that the Bristol directors have been taking measures which, it is hoped, will secure the opening of their division, and consequently of the entire line, in the middle of next year.—*Wilts Independent.* The opening of the extended line to Steventon, a distance of 52 miles from London, is announced to take place on the 1st of next month. We are happy to find that there is every probability of this grand undertaking being opened between Bristol and Bath early in September. The permanent way has been laid down in the neighbourhood of Keynsham to a considerable extent, and the locomotive engine is at work. Between Keynsham and Bristol the road is all formed, and except finishing off the head of No. 3 tunnel, is in a perfect state. The beautiful elliptic Gothic-arched bridge across the Avon, near the station, is completed, and presents a most splendid appearance. The work does infinite credit to the contractors, Messrs. Wilcox and Son.—*Bristol Mirror.*

Preston and Wyre Railway.—This line of railway, it is expected, will be opened to the public on the 1st or 2nd of July next—the North Union Company finding locomotive power and carriages. Above 1,000 men are engaged in the various works in progress at Fleetwood, among which may be mentioned an hotel, intended to be one of the finest buildings of the kind in the kingdom. A quay of considerable length, the foundation of which rests on iron piles, is also in progress. A light-house, on Mitchell's patent screw principle, has been erected on the end of a sand bank, about two miles out to sea, and will be lighted in the course of next month. The house and lantern stand from 60 to 70 feet high. Captain Denham, R.N., has been for some time busily engaged taking bearings for two other light-houses, which are intended shortly to be commenced. It is intended so to lower the bar, by dredging, that there shall never be less than 12 feet water at low water high spring tides, from the sea direct into the harbour, which can readily be effected. The town of Fleetwood has been tastefully laid out by Decimus Burton, Esq., of London, and a considerable number of houses are in progress.—*Lancaster Guardian.*

Birmingham and Gloucester Railway.—We can now confidently state that the Birmingham and Gloucester Railway will be opened on or before the 1st of July next, from Barnt Green, eleven miles from this town, to Cheltenham. Conveyances will be furnished by the company to perform the intermediate distance, and by the end of the year it is fully calculated that the whole line will be completed, and opened to the public from Birmingham to Cheltenham. —*Midland Counties Herald.*

Northern and Eastern Railway.—A correspondent informs us that the opening of the first portion of the Northern and Eastern Railway will take place at least two months sooner than was anticipated—namely, in August next. We learn from other quarters, that the greatest energy is displayed in the prosecution of the works.—*Ibid.*

Manchester and Birmingham Railway—The exertions of the various contractors, on this line of railway, at the temporary Manchester terminus, in Travis-street, London-road, have, for the last four or five weeks, been quite astonishing. Since the 1st of April, no fewer than six more arches, of thirty-three feet span, have been completed, besides another skew bridge. The magnitude, or rather the extent of the work, may in some measure be estimated, when it is stated that the arches and bridge have consumed nearly seven millions of bricks. The immense scaffolding or centering, rendered necessary for the erection of the iron skew bridge, which has so justly attracted public notice, has this week been removed, and this noble mechanical structure, which has certainly not its equal in the kingdom—perhaps not in the world, may now be seen to the best possible advantage. Mr. Buck, the company's engineer, has, it is said, the rare merit of designing this extraordinary work of art. The permanent rails are now in the course of being laid; the mode of doing which presents to the eye of the scientific man a degree of firmness and probable durability not perhaps equalled, or even nearly approached, by any other railway line in the kingdom. The rails, remarkably heavy, are fifteen feet in length, and laid on longitudinal pieces of Kyanised timber, the scantling of which is twelve inches by six inches. There are besides transverse pieces, also Kyanised, ten inches by five inches, and screwed to the longitudinal ones every three feet, so that it may with safety be pronounced impossible that the rails, when once truly and firmly fixed in their chairs, can ever afterwards be other than completely parallel to each other; a circumstance that cannot fail to give a motion to the carriages so thoroughly easy and agreeable, as to bid defiance to all attempts at improvements on the plan. When the arches, now 110 in number, are extended to the intended permanent station, Piccadilly, near the Infirmary, the entire length of the viaduct on brick arches will exceed two miles; and the quantity of timber that will be consumed in laying the rails for this length only, will exceed 20,000 cubic feet. It is intended to open the railway, as far as Stockport, on the 29th May.—*Manchester Chronicle.*

Lancaster and Preston Junction Railway.—This railway will be opened for the conveyance of passengers, and of traffic, on Whit-Monday. The works proceed at the Lancaster terminus with considerable activity. A single line of rails has been laid down as far as Galgate, and during the past week a number of men have been despatched to the contract of Messrs. M'Mahon, which, it is rumoured, the Directors intend to take into their own hands, in order to ensure the completion by the 6th of next month, which otherwise is more than problematical.—*Railway Times.*

Paris and Rouen Railway.—The contract entered into between the Southampton Railroad Company and that between Paris and Rouen has been signed, and the works will be commenced immediately. The present railroad from St. Germain will form the nucleus, and from the same point it is imagined the railroad to Belgium might be commenced, and hence that goods could be forwarded directly from Rouen to Brussels, without having to pass through the French capital.—*Globe.*

Glasgow and Ayr Railway.—The most active exertions are making along the line in order to effect the completion of the whole line by the end of July. Betwixt Kilwinning and Dalry the cutting and embanking is carried on during the night as well as the day; and the contractor of this lot, hitherto in the most backward state, is proceeding with the greatest vigour and success. Considerable progress has been made in overcoming the difficulties of the so called bottomless meadow, which has required so much deposit in the embanking. The most formidable part of it yet remaining extends to about three hundred yards; and it is singular to observe that as the earth is poured on the embankment, the surface on both sides is heaved up to a considerable extent. As the workmen proceed, they find each new piece of embankment to sink during the night, which depression they have to restore by fresh portions of surface material. Having once surmounted this obstacle, their task will be comparatively easy, as the embankment at this part of the line is only three feet. The meadow which lies betwixt Kilbirnie and Lochwinnoch Lochs, is supposed to have been at one time also covered with water, but it was not considered to have retained so much moisture as to cause such extra labour to make it properly *terra firma*, otherwise some change would have been made on the line, by which it might have been avoided. The lodging-houses in Kilwinning, Dalry, and Beith, are crowded with labourers employed on the railway, whose expenditure must be felt in a considerable degree by those villages. The iron-works at Dalry are in the progress of building, and appear to be on a very extensive scale.—*Glasgow Courier.*

ENGINEERING WORKS.

The Royal George.—Col. Pasley began his proceedings for the removal of the wreck of the Royal George on the 1st of last month, but up to the 12th nothing very remarkable was effected. Two guns, the rudder, and a considerable quantity of timber, were recovered; but as these were merely the fragments of last year's work which the inclemency of the season prevented the engineers from picking up, no serious measures were deemed necessary till Tuesday, 12 ultimo. At eight o'clock in the morning, the red flags at Spithead announced that a great explosion was to be attempted; and at eleven one of those huge cylinders which have formerly been described, filled with 2116 lb. of gunpowder, was lowered to the bottom. One of Col. Pasley's divers (George Hall) who has acquired great expertness in these operations, descended his rope-ladder a little in advance of the cylinder, and succeeded in fixing it securely to one of the lower gudgeons or braces on the rudder-post, within six or eight feet of the keel. The diver having remounted, and the vessels being withdrawn to a safe distance, the enormous charge was ignited by means of the voltaic apparatus. Within less than two seconds after the shock was felt, the sea rose over the spot to the height of about 15 feet, or no quite half so high as it did on occasion of the great explosions last year—a difference ascribable, probably, to the cylinder on the present occasion having been placed under the hull instead of alongside it. The commotion in the water, however, was so great as to cause the lumps and lighters to pitch and roll at a great rate. The whole surface of the sea for several hundred yards round was presently covered with dead fish and small fragments of the cylinder. Amongst these were innumerable tallow candles, and a mass of butter a foot and a half in length, evidently driven up from the purser's store-room. As soon as the vast commotion in the water had subsided, and the boats had returned from the universal scramble for the candles and dead fish, the diver proceeded again to the bottom, and soon reported that the whole stern of the ship had been driven to pieces, and that, so far as he could ascertain, there was now a free and wide channel directly fore and aft the ship, from stem to stern, through which both the flood and ebb tides will rush, and thus the mud with which the hull of the Royal George has been silted for half a century, will be washed out, and the way cleared for Col. Pasley's further operations.

Staffordshire and Worcestershire Canal Company.—This company, having purchased of the Moat Colliery Company the unexpired term of their lease of the river Sowe, up to this town, have this week employed no less than 150 men in improving and making navigable for heavily laden vessels, that part of it between this town and Radford Bridge. The work has been actively proceeded with, the bed of the river being lowered in some parts about two feet, widened or narrowed as required, and thoroughly cleansed. This improvement has been effected with the view of opening a market for Lord Hatherton's and other collieries at Church Bridge, near Cannock, to which place a branch from the canal is in progress, at an estimated expense of £20,000. It is expected that the branch will be completed by the end of the present summer; so that the inhabitants of this town may reasonably expect both a cheaper and better supply of the necessary article of fuel.—*Staffordshire Gazette.*

Portsmouth Dockyard.—A Board of Admiralty, consisting of Earl Minto and Sir W. Parker, lately visited the port. Several material points have called their Lordships' attention to this neighbourhood: in the first place, the floating bridge approaches required their inspection, in which they were assisted by their engineer, Captain Brandreth; and we have no doubt that all matters in dispute will be satisfactorily arranged for the company, and advantageously for the public. We have reason to think that Mr. Lindegren's projecting premises will be purchased and thrown open, by which means upwards of 60 feet of high water beach will be available to the watermen; care, however, should be taken that the new beach be properly formed, for, as the situation is removed from the operation of the tidal influence on the shingle, nature will provide nothing but mud to land on, unless the engineer shall exercise his art and procure a more hardened substance.

NEW CHURCHES, &c.

Dorsetshire.—The foundation stone of the new church at Ash was laid on Wednesday, 13th ult., by the Rev. R. Oakman, the vicar, in the presence of a very large company, comprising about 2,000 of the nobility, gentry, and yeomanry of the county.—*Dorset County Chronicle.*

Nottingham.—The beautiful church of St. Mary, which has justly excited so much admiration from antiquaries, has been completely restored, at an expense of 3,000*l.*, which sum was raised by subscription; and Mr T. Wright, of Upton-hall, has purchased and presented to the church a beautiful Crucifixion, by Fra Bartolomeo, and one of his finest works, as an altar-piece.—*Nottingham Herald.*

Essex.—North and south transepts are now in progress at the parish church of Messing, near Colchester, under the direction of John Burges Watson, Esq., of 39, Manchester-street, London. The style is early English; there is a beautiful eastern window in stained glass and of great antiquity, supposed to have been of Dutch origin, and is an object of attraction to visitors; it is also contemplated to have a new tower and spire, for which designs have been furnished.

Sisters of Mercy in Birmingham.—John Hardman, Esq., of Handsworth, has generously allotted to the use of this establishment, a piece of land opposite his own dwelling; and a convent is now in progress, from the designs of A. W. Pugin, Esq., the architect of St. Chad's Church. The conventual buildings will consist of chapel, cloister, community room, refectory, offices, and private chambers, or, as the are technically termed, cells; to which will be added a refectory, school-room, and suitable apartments for about thirty female orphan children. The plan of the building is based chiefly upon that of "Brown's Hospital" in Stamford; and, as Mr. Pugin studies propriety of destination in all his edifices, we have reason to know that the one in question will not only be ornamental and picturesque, but in every respect *conventual*—in fact, the only entire building, with purely conventual features, in the country.—*Midland Counties Herald.*

Staffordshire.—The new church of St. James', at Handsworth, was consecrated on the 22nd April last. It is built in the early Gothic style, with a tower of three stories at the west end, it contains 926 sittings, of which 518 are free. Mr. Richard Robinson of Wolverhampton, was the contractor, for the sum of £2,500,—and Robert Ebbels, Esq., the architect.

MISCELLANEA.

Artificial Asphalte.—The substitution of boiling coal tar instead of water, with crushed caustic lime and screened gravel or sharp sand, in the usual proportions for making concrete, forms an admirable asphalte, perhaps equal to the foreign asphalte.

C. F. P.

Wood Pavement.—A considerable length of the Strand is now being paved with wood; the blocks are hexagonal, 9 inches deep, and 9 inches across at right angles to the sides; the upper edge is chamfered all round, to form a groove to prevent the horses from slipping. The wood is laid on a bed of broken granite, and to us it appears that the work is being done in a very clumsy and unsatisfactory manner.

Asphalte.—This material has been used in lining the reservoirs and tanks of the Southampton Railway, and found to answer very well; it has also been used for covering terraces—in some situations it has not been very successful, but in others it is perfectly water-proof. An additional length of the footway in Whitehall has been laid with this material.

Thames Tunnel.—The Company have obtained another Act of Parliament, which empowers them to purchase the property on the Middlesex side of the river necessary for the approaches; the works will now proceed with rapidity. The tunnel is completed to within 50 feet of the wharf at Wapping, and preparations are making to commence immediately the sinking of the shaft on the Middlesex side of the river. The formation of the new shaft, as well as the remaining portion of the tunnel, will be carried on at the same time, and it is expected that in about four months they will be completed. Not less than 150 workmen are at present engaged in finishing the interior of the western arch roadway, preparatory to its being opened, in the first instance, as a thoroughfare for foot passengers.

To consume the smoke from a boiler furnace.—Let the fresh coals be put into the furnace as near to the door as possible, and leave the door open for a space of two or three inches to allow cold air to enter, this will keep down the greater part of the smoke which will be consumed; the same may be applied to marine engines. This method will be found as efficacious as any patent that has yet been taken out. M.

Safety Valve to Steam Boilers.—At a meeting of the Society of Arts, on Wednesday, May 6th, the gold Isis medal was awarded to Mr. Robert M'Ewen, for a mercurial gauge which answers the double purpose of an indicator of steam-pressure and a safety-valve for engine boilers. The novelty of the invention consists in the employment of a mercurial tube as a safe-vent for the steam. these tubes having hitherto been used only as indicators of pressure, and of a length sufficient to allow the steam to acquire a dangerous degree of pressure, without giving any other notice of the fact than what may be observed by the eye. As the action of Mr. M'Ewen's safety-valve depends on a purely *physical* principle, viz., the opposition of the elastic force of steam to the static pressure of mercury without a *mechanical* obstruction of any kind, it affords a free vent for the steam when its pressure exceeds the limit, corresponding to the length to which the tubes are adjusted, according to the strength of the boiler.

India Coal.—Dr. Hutchison, of the Madras artillery, has drawn up a report on the coal-fields recently discovered in the vicinity of Mergui, by which it appears that this coal is easy of access, lying at no great depth beneath the surface, so that shafts may be sunk without difficulty. For its conveyance there seems to be every facility, the river being adjacent, and a land carriage of one mile only being required. It is not stated whether the quality of the coal has been tested by experiment, but we presume it to be the same of which Dr. Heifer spoke so highly in his communications. Steamers will begin to ply between the different ports in the bay of Bengal; and the immediate coal dépôts between the Presidencies and Suez will be more plentifully supplied, and at a cheaper rate. The effect these circumstances will produce on the destinies of India can scarcely be estimated.—*East India Magazine.*

LIST OF NEW PATENTS.

GRANTED IN ENGLAND FROM 28TH APRIL TO 23RD MAY, 1840.

William Crane Wilkins, of Long Acre, Lamp Manufacturer, and Matthew Samuel Kendrick, of the same place, Lamp Maker, for "*certain improvements in lighting and in lamps.*"—Sealed April 28; six months for enrolment.

John Inkson, of Ryder Street, Saint James', Gentleman, for "*improvements in apparatus for consuming gas for the purpose of light.*" Communicated by a foreigner residing abroad.—April 30; six months.

Orlando Jones, of the City Road, Accountant, for "*improvements in treating or operating on farinaceous matter to obtain starch and other products, and in manufacturing starch.*"—April 30; six months.

William Pierce, of James Place, Hoxton, Ironmonger, for "*improvements in the construction of locks and keys.*"—May 2; six months.

Arthur Wall, of Bermondsey, Surgeon, for "*a new composition for the prevention of corrosion in metals, and for other purposes.*"—May 2; six months.

Thomas Gadd Matthews, of Bristol, Merchant, and Robert Leonard, of the same place, Merchant, for "*certain improvements in machinery or apparatus for sawing, rasping, or dividing dye, woods, or tanners' bark.*"—May 5; six months.

William Newton, of Chancery Lane, Patent Agent, for "*an improved apparatus and process for producing sculptured forms, figures, or devices in marble, and other hard substances.*" Communicated by a foreigner residing abroad.—May 5; six months.

George Mackay, of Mark Lane, Ship Broker, for "*certain improvements in rotatory engines.*" Communicated by a foreigner residing abroad.—May 5; six months.

William Beetson, of Brick Lane, Old Street, Brass Founder, for "*improvements in stuffing-boxes applicable to water-closets, pumps, and cocks.*"—May 5; six months.

Frank Hills, of Deptford, Kent, Manufacturing Chemist, for "*certain improvements in the construction of steam-boilers and engines, and of locomotive carriages.*"—May 5; six months.

Bernard Aube, of Coleman Street Buildings, Gentleman, for "*improvements in the preparation of wool for the manufacturer of woollen and other stuffs.*"—May 7; six months.

Thomas Walker, of Galashiels, in the county of Selkirk, Mechanic, for "*improvements in apparatus applicable to feeding machinery employed in carding, scribbling, or teazing fibrous materials.*"—May 7; six months.

Henry Holland, of Darwin Street, Birmingham, Umbrella Furniture Maker, for "*improvements in the manufacture of umbrellas and parasols.*"—May 7; six months.

Henry Montague Grover, of Boveney, Buckinghamshire, Clerk, for "*an improved method of retarding and stopping railway trains.*"—May 7; six months.

Miles Berry, of Chancery Lane, Patent Agent, for "*certain improvements in treating, refining, and purifying oils.*" Communicated by a foreigner residing abroad.—May 9; six months.

Auguste Moinan, of Philpot Terrace, Edgware Road, Clock Maker, for "*certain improvements in the construction of time-keepers.*"—May 9; six months.

Rice Harris, of Birmingham, Gentleman, for "*certain improvements in cylinders, plates, and blocks, used in printing and embossing.*"—May 12; six months.

George John Newberry, of Cripplegate Buildings, Manufacturer, for "*certain improvements in rendering silk, cotton, woollen, linen, and other fabrics, waterproof.*"—May 12; six months.

Henry Dircks, of Liverpool, Engineer, for "*certain improvements in the construction of locomotive steam-engines, and in wheels to be used on rail and other ways, parts of which improvements are applicable to steam-engines generally.*"—May 12; six months.

John Davidson, of Leith Walk, Edinburgh, for "*an improvement in the method of preserving salt.*"—May 12; six months.

Peter Bradshaw, of Dean, near Rimbolton, Bedford, Gentleman, for "*improvements in dibbling corn and seed.*"—May 12; six months.

James Walton, of Sowerby Bridge, Halifax, Cloth Dresser, for "*improvements in the manufacture of beds, mattresses, pillows, cushions, pads, and other articles of a similar nature, and in materials for packing.*"—May 12; six months.

Richard Foote, of Faversham, Kent, Watch Maker, for "*improvements in alarums.*"—May 12; six months.

John Joseph Mechi, of Leadenhall Street, Cutler, for "*an improved method of lighting buildings.*"—May 12; two months.

Bryan J'Anson Bromwich, of Clifton-on-Teme, Worcester, Gentleman, for "*improvements in stirrup-irons.*"—May 13; six months.

Henry Ernest, of Gordon Street, Middlesex, Gentleman, for "*certain improvements in the manufacture of machines, usually called beer-engines.*"—May 13; six months.

William Hannis Taylor, of Norfolk Street, Strand, Esquire, for "*certain improvements in the mode of forming or manufacturing staves, shingles, and laths, and the machinery used for that purpose.*"—May 20; six months.

William Bush, of Camberwell, Merchant, for "*improvements in fire-arms and in cartridges.*" Communicated by a foreigner residing abroad.—May 20; six months.

James Buchanan, of Glasgow, Merchant, for "*certain improvements in the machinery applicable to the preparing, twisting, and spinning, and also in the mode of preparing, twisting, and spinning, of hemp, flax, and other fibrous substances, and certain improvements in the mode of applying tar or other preservative to rope and other yarns.*"—May 22; six months.

James Callard Davies, of College Place, Camden Town, Jeweller, for "*an improved clock or time-piece.*"—May 23; six months.

TO CORRESPONDENTS.

If W. B. *will favour us with the particulars of the addition to Thorney Abbey, we will insert them next month.*

S. P.'s *method of constructing a Bridge is impracticable, it is like building castles in the air, his communication will be left at our office.*

We thank Mr. Plank *for his correction, it will be forwarded to the author of the paper.*

Mr. Phillip's *communication is unavoidably postponed, together with some others.*

"Amicus" *is not aware of the difficulties and delays in getting the reports he mentions, we have inserted some in the present Journal.*

"*Report on the plans for preventing accidents on board of steam vessels,*" *we had intended to have given this month, but in consequence of an over pressure of matter, we are compelled to postpone it for the next Journal.*

We are obliged to Capt. P. *for his communication, the extracts from Palladio we have not inserted, as the work is accessible to most architects—his other paper explaining how increased buoyancy might be obtained by filling the sides of vessels with gas in reservoirs, we think is impracticable, as the weight of the reservoirs containing the gas and the increased ballast at the bottom of the vessel, will more than counterbalance the buoyancy of the gas.*

The communication from Mr. Nicholson's *reply to* Mr. Buck, &c., *was received too late in the month for the present Journal, we will not fail inserting it next month.*

Communications are requested to be addressed to "The Editor of the Civil Engineer and Architect's Journal," *No.* 11, *Parliament Street, Westminster.*

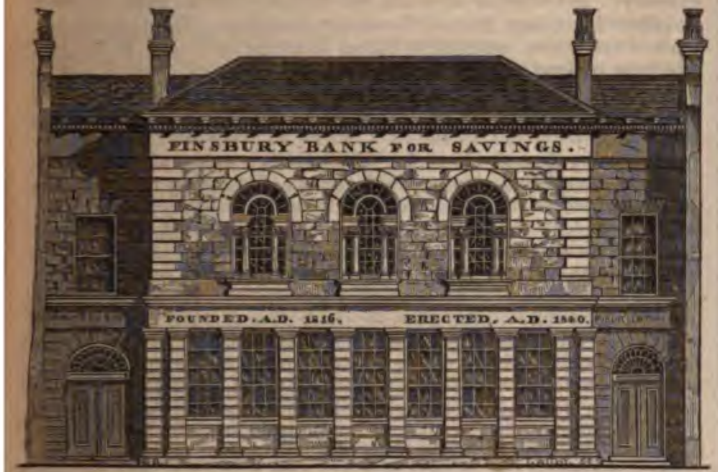
Books for review must be sent early in the month, communications on or before the 20th *(if with wood-cuts, earlier), and advertisements on or before the* 25th *instant.*

The First Volume may be had, bound in cloth and lettered in gold, Price 17*s*.

⁂ The Second Volume may also be had, Price 20*s*.

FINSBURY SAVINGS' BANK.

ARCHITECT, ALFRED BARTHOLOMEW.


FINSBURY BANK FOR SAVINGS.
FOUNDED. A.D. 1816.
ERECTED. A.D. 1840.

THE sum allowed for the erection of this building was only £2850, which, taking into consideration its size, is not 50 per cent. upon the ratio of cost of any other of the savings' banks of the metropolis; the consequence is, that it is neither built externally of the materials, nor finished internally in the style, which the architect of it desired: a previous design was prepared by him for a larger and superior building, to be finished externally with Portland stone, internally fitted up in a handsome manner, and with the novelty of an entire fire-proof construction, the particulars of which are to be found in Mr. Bartholomew's "Specifications for Practical Architecture," just published. The absolute tender for the difference between external stucco and Portland stone (the frontage remaining the same), was less than 5 per cent. upon the cost of the original design, and less than 7 per cent. upon the reduced one; and the fire-proof construction added only about 6 per cent. to the cost.

The frontage of the building extends 72 feet, and consists of a range of seven large windows, for the admission of a great body of light to the offices, between ten rusticated pilasters, 13 ft. 6 in. high, which are diminished. They are surmounted by an entablature; above is a range of three Palladian windows (lighting a board-room), flanked by long rustic quoins, and surmounted by a fascia and a bold cornice, from the outer edge of which commences the slope of the roof, which has a sunk or concealed gutter. At the sides of the pilastrade before mentioned, are rusticated wings, containing the entrances, each 6 feet wide, above which the building retires, so as to detach it from the adjoining houses. All the fascias are made very broad, for the purpose of receiving inscriptions to be visible at a considerable distance.

The interior of the building, which is totally destitute of every description of decoration, contains a public office 30 feet long, three private offices, a strong-room, a depositors' waiting-hall 44 feet long, two entrance halls, each 11 feet 8 inches by 20 feet, a board-room 30 feet by 14 feet, two staircases, and besides these thirteen domestic apartments, most of which are concealed from view in order to avoid as much as possible the meanness of many small external windows.

All the proportions of this building have suffered from retrenchment, and it is thus rendered in dimension, having regard to its business, twice as large as any similar establishment.

The external cornices and chimneys are not yet finished.

The sum allowed for this building was so restricted, that the architect chose to be at some part of the expense of the external decorations of it, rather than suffer it to undergo farther mutilation.

ON THE PRESENT STATE OF THE ART OF GLASS PAINTING IN ENGLAND AND FRANCE, AND ON THE NECESSITY FOR EFFORTS IN ITS FAVOUR.

BY GEORGE GODWIN, JUN., F.R.S. & S.A.*

THE extraordinary degree of apathy universally manifested with regard to the well-being and progress of an art, the admirable results of which throughout a period of at least five or six hundred years are scattered over the whole of Europe, is so much to be lamented, and calls so loudly for exertion on the part of those who feel its importance, that I am induced to raise earnestly a feeble voice in its behalf. And I do this without any fear of the imputation of vanity or self-confidence, and with a strong hope that however weak the advocate, some good may be effected by the effort. Many men with earnest wishes and strong inward promptings, avoid speaking out simply through feelings of their own want of importance and dread lest interference on their part may be construed into presumption, or at the best be entirely disregarded. This I am disposed to think is an evil and should be combatted, experience showing that a word uttered in due season, however humble and weak the utterer, may, and often does, have effects which could not possibly have been calculated upon: and further, that an individual, however unimportant who with strong conviction iterates, and reiterates the necessity of a certain step will be sure of finding a response in the public mind, provided his statement be founded in truth, and sooner or later will most probably effect his purpose. This introduction is a little too pompous for the very brief remarks which follow, but nevertheless perhaps, may not be deemed useless or impertinent.

To bring together and relate the circumstances attending the progress of the art of painting, and staining glass from the foundation of Constantinople, where it attained a certain degree of excellence, and whence, there seems reason to believe, it was brought to Rome, and afterwards by our Norman, if not our Saxon, ancestors to England, would be a pleasant task, but as all the facts are well known, the repetition might prove tiresome. In the 14th and 15th centuries the art reached great perfection in England, and ultimately became so popular that stained glass was not merely used for ecclesiastical purposes, but as an essential feature of decoration in domestic architecture. At the Reformation the onward progress of glass painting was checked, and many fine specimens of it were destroyed as evidences and encouragers of superstition. Further ravages were made in the reign of Charles I. and during the continuance of the Commonwealth; indeed it seems surprising, bent as the Puritans were upon its destruction, that so much yet remains,

> "Innumerable of stains and splendid dyes.
> As are the tiger-moths deep damask'd wings,"

to prove its power in exciting holy emotions; "to add new lustre to religious light," and a further charm to the many inherent beauties of those numerous buildings in the pointed style of architecture scattered over England, of which we have just right to be proud.

Dallaway in the first edition of his "Observations on English Architecture,"† gives a valuable list of the various professors of the art of painting on glass, who practised in England from the period of the restoration of the reigning family up to the year 1805, when Francis Egington died,—a man of celebrity in the exercise of the art, who had been established near Birmingham.

A little time previous to this date, Charles Muss came to London to obtain employment as a colourer of prints. He lodged at the house of an individual who painted upon china for Messrs. Mortlock, and was induced by accident, on the death of his landlord, to undertake the completion of some work of this description which had been left unfinished. Succeeding in this he became a china painter, and ultimately a glass painter, and was employed in that capacity for many years by Mr. Collins of the Strand. He afterwards executed a number of works in his own name,—of which one of the finest that I know is a window in the church of St. Mary at Redriff. Muss had a number of pupils, some of whom are now practising: as for example Mr. Nixon and Mr. Hoadley. Backler, who painted the window at St. George's church in the Borough, was another of his scholars, as was also Mr. John Martin—since so deservedly celebrated in another branch of art; a man of whom it may be said, in a parenthesis, our age will boast hereafter.‡ A work in stained glass from his hands is, I believe, to be found at Lord Listowel's, at Kensington. The peculiarity to be observed in paintings of the Muss school, (I think it may also be termed the *defect*,) is the great degree of opacity given to some of the colours; whereas in the best works of the artists of the middle ages all the colours are more or less translucent. Of all Muss's living pupils Mr. Nixon, of the firm of Ward and Nixon, has perhaps most entirely abandoned this peculiarity, and the result apparent in such of the works executed by this firm as I have examined, is of an exceedingly satisfactory nature.

---

* The substance of this paper was read at the Royal Institute of British Architects, June 1, 1840.

† London, 1806.

‡ "It is only when we are skeletons that we are boxed and ticketed, and prized and shown."—*W. S. Landor.*

The branch of glass painting now most encouraged appears to me, although of itself charming, a departure from the special character of this art. I allude to the imitation of oil paintings on single plates of glass, or of plates composed of very few large pieces,—such for example as the copy of "Belshazzar's Feast," and others of Martin's wonderful conceptions, which have been so well executed by Messrs. Hoadley and Oldfield.

Dallaway says that Thomas Jervais, who died in 1801, was the first who was distinguished for exquisitely finishing small subjects, since which time this department of the art has been much studied and has been brought to a point of great excellence. In productions of this sort a variety of colours are fused into the same piece of glass, and it becomes almost impossible to obtain with such certainty equal effects of colour, as when each tint is on a separate piece of glass, although this style has undoubtedly its own advantages. In the works of the earlier manner the colours are nearly always on separate pieces, the various morsels being united by leaden or copper bands, and shaded with brown. A hardness of outline resulted, and a great excellence in drawing was not easily attainable, but there is nevertheless about them a character peculiarly their own which should not willingly be lost in decorating ecclesiastical structures of the style of the middle ages. Of course we should not give up the power we possess through our improved mechanical skill, to avoid injurious joinings where this can be done without diminution of excellence in other respects; what I would simply express is, my conviction that to endeavour to make stained glass appear to be anything else than stained glass is not desirable.

An error, as it appears to me, is sometimes committed in placing copies of the later Italian masters in the windows of structures erected in the earlier pointed styles of art. Our improved taste has made us feel that to place an Italian altar-piece in a Gothic church is to violate propriety and destroy harmony. Why should the filling-in of the windows escape the general law that all portions of a building avowedly in imitation of the works of a particular period should be congruous. The windows ought unquestionably to accord with the building itself, both as regards their design and the technical peculiarities which mark the genuine works of the period imitated.

Mr. Willement, whose works are well known to all who have inquired into the subject, is justly celebrated for his imitations of the efforts of the earlier artists in stained glass, and of these no other example need be given than the principal window in St. Dunstan's church, Fleet-street, executed by him a few years since. This window was presented to the parish by the Messrs. Hoare.*

In France at this time the art of painting on glass is making satisfactory, although but gradual, advances. During the period of the first revolution the abhorrence of every thing connected with royalty which prevailed, led to the suppression of the government establishment for the manufacture of glass and china at Sêvres, and to the destruction of numerous fine specimens of its skill. While many glass windows were broken and melted down in the vain belief that as gold was employed in the preparation of some of the colours, it could be extracted and made available. Buonaparte sought to re-establish the manufactory on its former footing, but found that, although they possessed all the written details of the processes, France which had produced so many noble works in stained glass, and the most perfect existing history of its progress and manufacture, was unable then to furnish artists capable of regaining for the establishment any of its former reputation. The art however was still exercised, but so little progress was made that prior to the year 1825, the practice of it appears to have been confined to this royal establishment at Sêvres, fame, not profit, being the object aimed at, and even there great success does not seem to have attended their efforts, if we may judge from the following circumstance. A window of painted glass was completed at Sêvres in 1827, for the church of *Notre Dame de Lorette*, and when fixed, which did not occur until some years afterwards, in consequence of the building remaining unfinished, it was declared to be a *chef d'œuvre* of modern art. In less than eighteen months however, as I am informed by a correspondent, the colours had faded so considerably as to render the window a public monument of failure, and permission to take it down was in consequence applied for. The dampness of the building was the cause assigned for the mishap, but insomuch as the carcass had been erected many years, this could not have been very excessive: and whether so or not, this failure could not have occurred had the colours been properly fused into the glass. Want of effect in some of the works executed at Sêvres has been attributed to the employment without modification, of the same mode of operation as is successfully adopted for porcelain. The bases of the colours are the same for one as for the other; but glass, in consequence of its translucent nature, requires that the tints should be much more intense than it is necessary they should be for china, which is opaque.

We have said that, prior to 1825, the art of painting on glass was nearly confined to the establishment at Sêvres. In that year Monsieur le Comte de Chabrol, then Prêfet of the Seine, entered into correspondence with Mr. Jones, a pupil of our countryman, Charles Muss, already mentioned, the result of which was that Mr. Jones went to Paris with the intention of forming a government establishment for painting upon and staining glass, in which pecuniary profit was to be regarded as a main consideration. Immediately on the arrival of Mr. Jones, M. de Chabrol was virulently attacked for affording encouragement to a foreigner "to the injury of native talent," and for four years the question was violently agitated without any result. At the end of that time, fatigued by the continued opposition to which he had been subjected, Mr. Jones abandoned the idea of a government establishment, and devoted his energies to forming and carrying on with success a private undertaking. He proposed to the proprietors of the glass works at Choisy le Roi, two leagues from Paris, to establish a department for staining and painting on glass, in conjunction with the other operations. They assented to his views, affairs were put *en train*, and success has attended the attempt. Nearly all the persons at present employed in it have been educated to it by Mr. Jones, and, in consequence, work well together, a circumstance which, in connexion with the opportunities he possesses for making experiments at small cost, and the comparatively trifling expence of the recipient in France, places stained and painted glass within the means of a much larger class of persons there than it is in England. Green, blue, or red glass, for example, may be bought in Paris for 1½ franc per foot, purple for 2 or 2½ francs, and ruby for 3 francs. Progress in the art of staining glass appears to have been greatly aided by M. Bontems, the director of the works at Choisy, who has devoted much time to the attainment of the ruby coloured glass of which such magnificent specimens are to be found in earlier works. I am informed he has succeeded, after repeated experiments, in obtaining it at a much cheaper rate than formerly by the use of oxide of copper instead of oxide of gold, and without any diminution of excellence. The experience of English glass stainers is opposed to this statement, as all ruby coloured glass prepared here from copper is inferior. I am not able, however, on this point to do more than repeat what I am told. M. Bontems has recently visited the costly establishments of the King of Bavaria at Munich, where, although he found, as he considered it, an inferiority on the whole, he gained much information. The princely magnificence of the King of Bavaria in all matters that relate to art, and the extraordinary results he has produced in his little capital, will serve to throw a halo round his name in the pages of future historians..

The establishment at Choisy possesses an advantage in the friendly co-operation of some artists of talent, not glass painters. In order to render a design effective on glass, such changes and alterations from the original picture are sometimes necessary, as would be entirely objected to by painters nervously careful of their fame, so that it is sometimes difficult to find artists of ability willing to exert their talents for the purposes of glass-painting, as they must be subservient in a certain degree to him who has the execution of the work, and on whom of course depends the effect to be produced. The last works exhibited in Paris by the Choisy establishment were designed by M. Adolphe Fries, a warm friend of the undertaking, and obtained much commendation. It is hardly necessary to say that since the successful issue of the experiment at Choisy le Roi, attempts have been made to form other similar establishments, but, being ill conducted, have, for the most part, failed. Men were even seduced from Choisy by golden promises to aid the undertaking; but the directing mind being absent, found themselves powerless.

The works at Sêvres are chiefly limited to the supply of government wants. The only window lately executed by them which I have seen, is in the cathedral at *Eu*, near Dieppe. This was the gift of the King of the French, who, on more occasions than one, has evinced a strong desire to advance the arts in his kingdom.

---

* Although this paper does not pretend to give the names of *all* the professors of glass painting practising in England; (unfortunately necessarily few), the writer cannot omit to mention Mr. Millar, who has executed a number of works at Stonyhurst, and Mr. Wilmnshurst whose large production The Field of the Cloth of Gold" was destroyed by fire.

Circumstances are much more favourable in France to the progress of the art of glass painting than they are in England. The material is so much cheaper, and the remuneration expected by artists for their labour is so much less, even after making all allowances for the difference in the value of money in the two countries, that the greatest obstacles in the way of experimental essays amongst us do not exist there.

It is really to be desired that some efforts will shortly be made in England by men in authority, to prevent the decay of an art so beautiful and so valuable as this which we are now considering. Its present languid state is most deplorable to behold, and cannot but terminate fatally unless means be taken to inspirit and invigorate those who are engaged in it. It is not asked that government should form large and expensive establishments for this purpose, as at Munich, such a course is not necessary, perhaps, even, it would be unadvisable; but it does appear exceedingly desirable that they should, by occasional commissions and discriminating assistance, draw public attention to the subject, raise the hopes of its professors, and offer some inducement for increased exertion on their part. In consequence of the improved state of chemical and physical science, we have the means of producing works in painted glass superior to anything that has yet been done, were proper encouragement afforded to develop our resources; unfortunately, a directly contrary opinion prevails, and this fact, therefore, cannot be insisted on too vehemently.*

Concerning the importance of stained glass,

> " glass of thousand colourings,
> Through which the deepened glories once could enter,
> Streaming from off the sun like seraphs' wings."

to increase the solemnity of an ecclesiastical building, and induce holy and religious feelings—apart from its influence as a work of art—none disagree; and yet, in consequence of the niggardly and ill-advised system of church building pursued at this time, few of the new edifices which are rising in all directions—mean, contracted, and poverty-stricken—afford any specimens of it. If government were to set an example by the bestowal of a few windows, there are many individuals and public bodies who might be persuaded to follow it. In early times, when funds were needed for the erection of places of worship, the mendicant monks promised all who would subscribe, that they should be represented in stained glass,—that they should

> " knely before Christ in compas of gold,
> In the wyde windowe westward, Wel neigh in the middell."

Notwithstanding it be pandering to the vanity and pride of frail humanity, we would promise this and more than this, to all who were willing to aid in the improvement of our churches, and to forward an art which has such claims upon the moralist and the man of taste; and we would point out that, by assisting to implant a knowledge and a love of art in the minds of their fellow men, they were advancing their welfare, raising them in the scale of beings, and effecting a national good.

Let us hope that better times than the present are in store for the lovers of this particular art—or rather, let us not be contented with simply hoping, but diligently set our own shoulders to the wheel, and vigorously assist to bring about that which we all admit to be so desirable.

MEDIEVAL ARCHITECTURE IN FRANCE.—No. 2.

(Continued from page 145.*)*

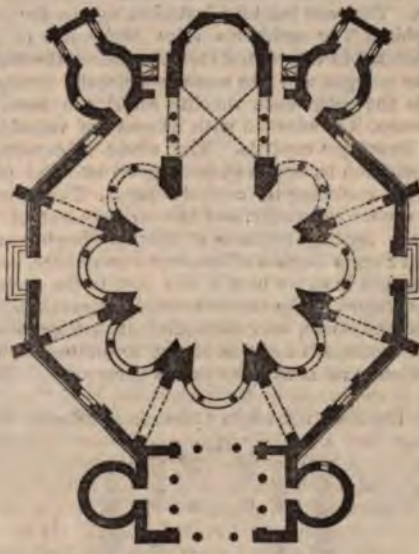
BYZANTINE STYLE.

THROUGHOUT a great part of the existence of what is called Gothic architecture, the Byzantine style flourished in France, both in distinct monuments, and as influencing other styles. In order to appreciate the character of this influence, we have considered it necessary not to limit ourselves to the examples afforded by France, seldom pure, but to investigate its history in other countries, so that thus we may be enabled to see the extent to which it has acted on other schools of art. It must be recollected that it was not until the eleventh century that the Greek and Latin churches were completely separated, while, during the whole period Constantinople contested with Rome for the supremacy. Down to that epoch Constantinople might be regarded with more propriety as the common centre of the Christian church than Rome, most of the general councils being held in the eastern empire, which was the great seat of learning. The bishops of Rome and Constantinople long contended for the jurisdiction over the provinces to the north of the Danube, and that the Greek patriarch was not without his influence, may be seen in many of the monuments to the north of the Alps. In France and in Germany, the examples of the Byzantine style are only partial, but in the Slavonic countries it is the predominant type to this day.

PLANS.

The first portion of the subject to which we shall call attention are the dispositions adopted in the arrangement of the ground plan of eastern churches, which, as was seen in the preceding article, completely altered the system copied from the Roman temples. Eusebius, in his life of Constantine,* describes some of the principal churches erected by this emperor and his mother in different provinces of his dominions. They were mostly circular or octagonal, and surmounted by lofty domes. Thus was constructed the great church of Antioch, dedicated to the Virgin, and called the Golden Temple, erected by this prince in the twenty-second year of his reign; it was in the form of an octagon, surrounded with exedræ and chapels. In the exedræ and in the porch it was lawful to bury. The church of the Ascension, built by St. Helena, mother of Constantine, upon the Mount of Olives, was circular, as is proved by the plan drawn on wax in the 8th century, and engraved in the *Acta Sanctorum.* This temple and the church of the Holy Sepulchre, are the reputed types of several churches built by the crusaders in their native countries. The churches of St. Marcellin and St. Constantius at Rome, are similar in their arrangements and were surmounted with cupolas of stone or pottery like the Syrian monuments before mentioned.

Fig. 6.—Church of St. Vital at Ravenna.



One of the nearest approaches to the description of Eusebius is the church of St. Vitalis, at Ravenna, founded in 534, while that city was still the seat of the Greek exarchs. Its plan is that of an octagon having semicircular chapels and *exedræ* on several points of its perimeter, or it may be described as round outside and octagonal within. A gallery on the first floor, running round the central area, is the *gynecæum*, or gallery for women, who, in the primitive church, as in the eastern churches to this day, were separated from the rest of the congregation. A hemispherical cupola, raised a great height from the ground, covers the building, and lights it by means of windows cut in the base. Pendents or brackets support the vault at the points where the re-entering angles of the polygon prevent it from being placed directly on the wall. The Greek architect, in constructing this building, has had recourse to a system, of which this is an early example.† Feeling the necessity for extreme lightness, since the cupola is supported mainly by brackets, he has used pieces of pottery in the shape of a bottle without a bottom. These vessels, placed in contact, form first the base of the cupola, then the curve, being continued without interruption, and in spiral, until they reach the top. The inside, as observed in our last number (p. 144), is covered with cement, decorated with mosaics on a gold ground. To the round churches of France we have already alluded at p. 143.

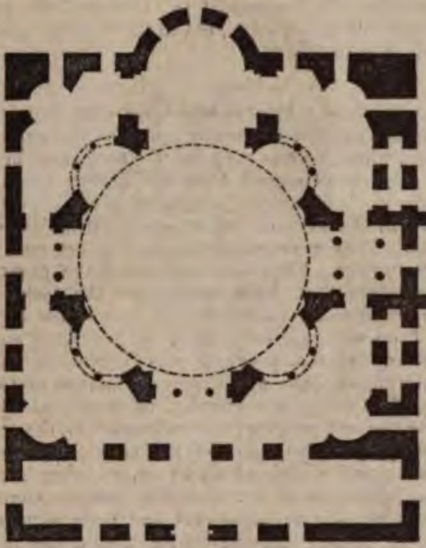
---

* It may be remarked here, that care should be employed by painters in the selection of glass for their works. Glass, as now made for ordinary purposes, is ill-suited for painting on. A few years ago, admirable glass for this object was obtainable from a factory at Dumbarton, which is not now in operation.

* Eusebius, Vita Constantini, l. iii, c. 50; and Abulfareius.

† Another is to be found in the octagon baptistery at Ravenna, built in 540.

Fig. 7.—Church of Sergius and Bacchus at Constantinople.



We now proceed to consider the works of a later date, from the 6th to the 13th century, when we come to the church of Sergius and Bacchus, now called by the Turks *Chutchuk agia Sophia*, or Little Sancta Sophia. This was built by Justinian, as was the large church of Sancta Sophia. The architects were Anthemius of Thrales and Isodore of Miletus. In the central area the plan is the same as at Ravenna, the same polygon and the same semicircular arrangements; on the first floor is the *gynecæum*, running round the nave. Like the church of Ravenna, it is adorned with columns of valuable stone, surmounted with Byzantine capitals. The whole is covered with a cupola. A modification is, however, introduced into the plan; the exterior is a square, enclosing the central octagon. The church of Sancta Sophia is also square externally, and the arrangement of the interior preserves all the leading features of that of Sergius and Bacchus. The example of Sancta Sophia affected art everywhere, and the square system was adopted in every part of the east, to the exclusion of the circle and the octagon. The two succeeding engravings, Figs. 8 & 9, of the Panagia Lycodimo, and Cathedral at Athens, illustrate this. The Panagia Lycodimo is towards Mount Hymettus, on the west of the city; the Cathedral is now the public library.

Fig. 8.—The Panagia Lycomido at Athens.

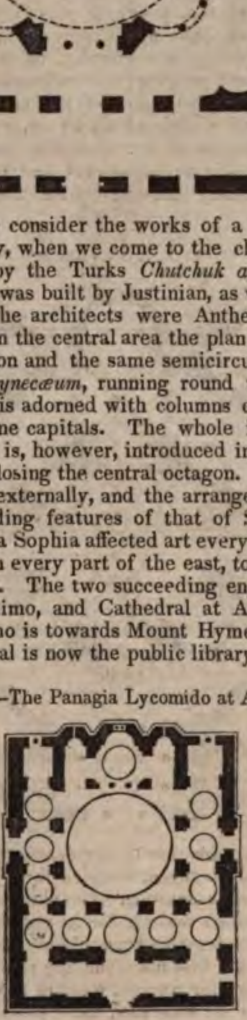
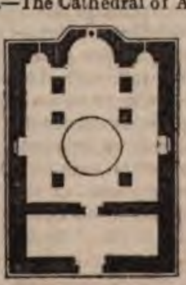


Fig. 9.—The Cathedral of Athens.

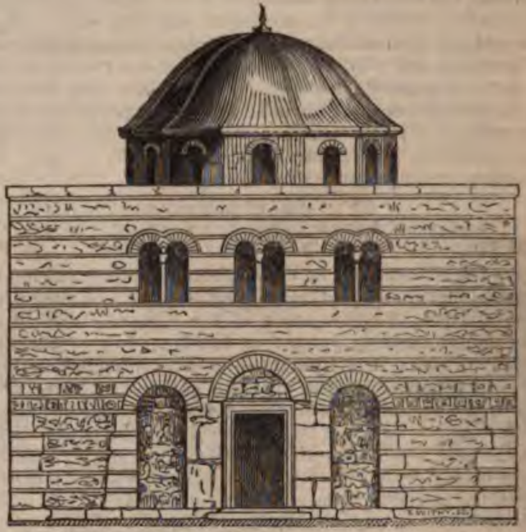


The plan of the *Ecs Miazin*, or the Three Churches, at Erivan, in Persia, one of the most celebrated Christian monuments of Asia, published by Chardin in his Persian travels, resembles the Cathedral of Athens. The only difference is in the form of the *narthex* or porch, which is square and open on three sides, whilst generally the vestibules occupy the whole breadth of the building. The *Ecs Miazin* has also a salient *absis* on each of its two lateral faces.

We may observe that it is from these models the Turks have borrowed the form of their mosques. Thus, also, they adopt a *Temenos* or square area isolating the building, and on the boundary of which are the residences of the officiating ministers and the tombs of their predecessors.[*]

ELEVATIONS.

Fig. 10.—Front of the Panagia Lycodimo at Athens.



The earliest Greek churches have a very simple front, a large mass, bounded at top by a horizontal line, without any pediment to indicate the inclination of the roof, carpentry not being used in Byzantine architecture, as cupolas and terraces only were used to cover in the building. Eusebius,[†] describing the basilica of the Apostles, says that rails cut out of gilt bronze were used to decorate the upper terrace, called the *Solarium*. It may be supposed from that, that the faces of the building were surmounted with horizontal cornices. The churches of Sergius and Bacchus, of Sancta Sophia, and of the Panagia Lycodimo (represented above), are all of the same kind; the square form being apparently preserved as late as the eighth and ninth centuries. These Byzantine churches are badly crowned, the upper entablature being composed only of a few mouldings, in which bricks are so placed as to form salient angles, and through which gutters are cut at different distances to carry off the water from the terraces or domes.

The first floor is generally marked on the front by a certain number of windows lighting the *gyneceum*. In the church of Sancta Sophia these windows are of large dimensions, semi-circular, and divided into three parts by two columns, which hold thin slabs or plates of stone, pierced with holes to let in the light.

Under the windows of the first story, or women's gallery, are placed the doors giving admission to the *narthex*, or porch. These doors are generally formed of lintels and door-posts, ornamented with elaborate mouldings, much in the style of the antique. Over the lintel a full arch, sometimes of stone and sometimes of brick, protects the door from the pressure of the superincumbent structure. The *narthex* was the place devoted to the catechumens, but in some of the later edifices it was used as a *gyneceum*, and thus the men entered the church by the north and south doors (*Noteiomeros*, *Boreiomeros*).

The early Byzantine basilicas have only a single dome, as in that of

---

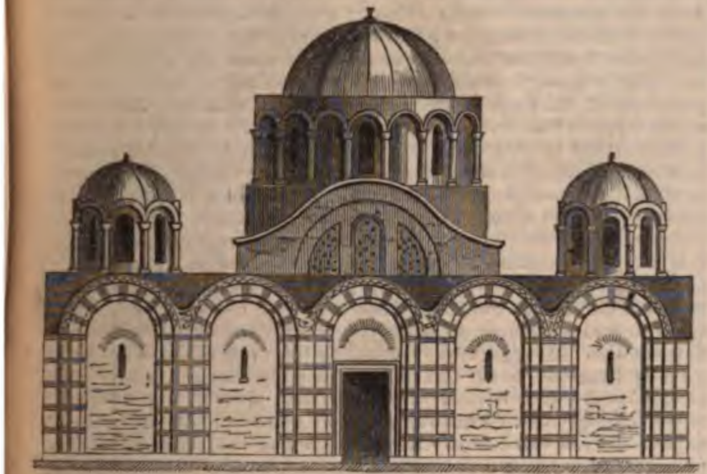
[*] Around the temple was a large space, on each of the sides of which were raised porticoes, connected together. Besides the basins (for purification) of the basilica, there were the habitations of the guardians supported by the porticoes, which they equalled in extent."—Eusebius in the Life of Constantine, l. xiv, c. 58, describing the Church of the Apostles, built at Byzantium by Constantine. We may, perhaps, find here the origin of the monastic cloister attached to our cathedrals.

[†] Eusebius, l. iv. c. 58.

Sergius and Bacchus at Constantinople. Sancta Sophia, in the same city, has a large central dome, and two semi-cupolas which cover the two curved portions situated to the east and west of the nave. These primitive domes are generally very heavy and cumbrous in form, differing from those which were erected later and elevated on tambours. A great number of small arched windows, very near each other, are cut through the base of the domes, and serve to light the interior. The effect of the light is so brilliant, that the cupola seems as it were isolated from the building. The cupola of Sancta Sophia, upwards of 120 feet in diameter, not being properly poised over the four main piers, in consequence of gathering the spandrils into too small a compass, exhibited, in less than 25 years, symptoms of approaching downfall, and the piers were accordingly strengthened on the outside.

Eusebius, Paul the Silent, and other authors, agree in describing the dome of the Church of the Apostles as being covered with dazzling gilt bronze, to keep off the rain.

Fig. 11.—Church of Mone tes Koras at Constantinople.



Another system of decoration succeeded this, and was much copied in Europe, as may be seen in St. Mark, at Venice, begun in 996. In this system the horizontal line, as bounding the front, was entirely given up, and was replaced by an arched line marking the extrados of the vaults. In the Greek islands are to be commonly seen, little chapels with a cradle-like roof covering the only nave, and secured with cement or sheet-lead. Where the building consists of several aisles, as most of the large Byzantine edifices at Constantinople, the roof has a festoon-like appearance, like so many round-covered trunks placed side by side.

Thus the exterior shows, as it were, the skeleton of the building, every series of arches in the building having the extrados delineated outside. So in the church of *Mone tes Koras*, (the House of the Virgin,) at Constantinople, represented above; the front consists of five great arches, and as another lateral series of arches runs across to form the *narthex*, this portion of the edifice is terminated at each end by one of these arches.

The domes which were erected at this period were more hemispherical, and the windows instead of being in the base of the cupola are formed in a tambour or cylindrical base, on which it rests. At this period too the domes began to increase in number and be added to the grand one forming the centre of the cross. In the church of the Pantocrator they crown the transepts and the anterior part of the nave, in that of St. Theodosia, now the mosque of the Rose, in the Fanar, the port of Constantinople, four secondary cupolas of the same form as the central one, but smaller, are raised at the four corners of the building. In some a dome is raised on the *narthex* as in the churches of the Pantocrator and Mone tes Koras. That of the Theotocos, near Solimanieh, has three placed symmetrically, one in the centre, and one at each end. The capitals of the columns in the Greek churches were placed on round shafts, and were little more than square blocks, tapered downwards, and adorned with foliage or basket work.

About the time of the Venetian Conquests began a union of Byzantine and Roman architecture, which is not one of the least curious forms of the style. Here is again restored the influence of the west, and pediments indicate the inclination of the roof, although the Greeks never used carpentry in their ancient churches. One of the finest examples of this period is the *Ecs Miazin*, a Christian temple of Erivan, published by Chardin, and more recently by M. Dubois. Of this style is also the building which down to 1827 was used as the cathedral of Athens.

Fig. 12.—Cathedral of Athens.

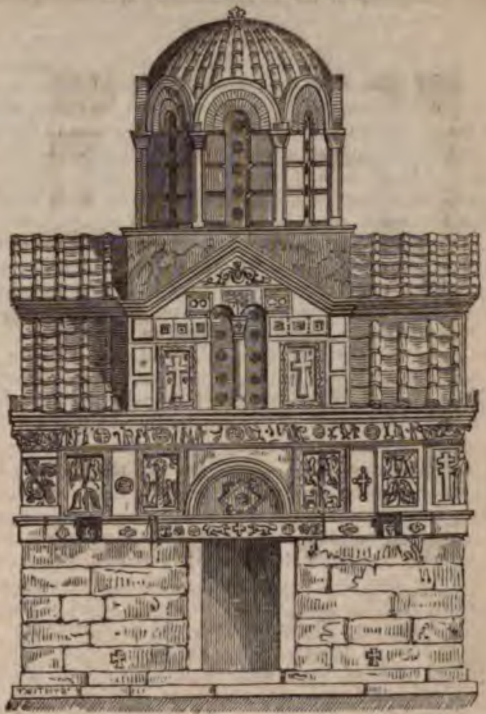
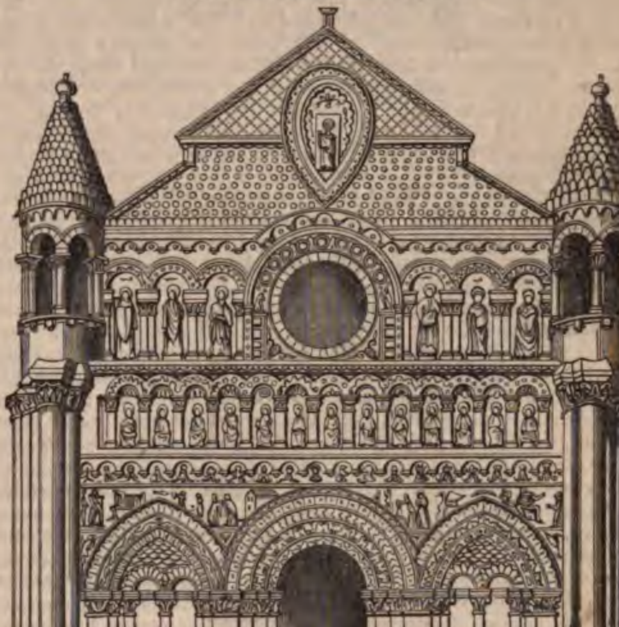


Fig. 13.—Notre Dame at Poitiers.



The figure above although partaking largely of the Roman, yet shows to what an extent the influence of the Byzantine school was felt, though in this case the interior presents much more points of resemblance than the outside. Our engraving, it must be observed, represents Notre Dame at Poitiers, not as it now is, but as it was before the gallery was broken through to enlarge the great window. This gallery although a type of the Gyneceum, is so far from being spacious, that in very few cases in the west of Europe, is there any communication through it. At Toscanella in the Roman States, and in the cathedral of Pisa, the original form is however preserved.

(To be continued.)

EXHIBITION—ROYAL ACADEMY.

(Continued from page 189.*)*

AMONG the practical jokes played off by the hanging committee in the architectural room, is that of placing a bird's-eye view where one must first get up a ladder in order to look down upon it, or in fact to look at it at all: which is no doubt exceedingly waggish and droll, but carrying the joke rather too far—at all events far above our heads; not that we care about it, because we have no relish whatever for drawings which carry us up into the clouds, in order to show us buildings as they would appear, viewed from a balloon. In itself the circumstance may be of little or no moment as far as the subject so placed is concerned, but it is certainly odd to meet with such blundering doings within the walls of a Royal Academy; where it certainly does bespeak a reprehensible systematic inattention to every thing connected with architecture. Lest we ourselves, however, should here be accused of inattention to our subject, we will resume our task of criticism by noticing two designs which we can heartily commend, and one of which we are glad to perceive is about to be executed. They are Nos. 1030 and 1050, both by Mr. J. W. Wild, and both for churches; the first being the "New Church, Streatham," to be executed under his superintendence; and the other a "Design for the Church proposed to be built at Paddington." They are neither Gothic nor Norman,—though the application of the round arch assimilates them somewhat to the latter; but in a style which has far more of the Lombardic character, and which, as shown is marked by picturesqueness no less than by simplicity, owing to the unusual breadth of surface and fewness of parts, on which account the Streatham church more particularly forms so striking a contrast to the impoverished, yet would-be-fine structures of the kind that have sprung up of late years in and around the metropolis, differing more or less from each other in their patterns, but all pretty much on a par as to taste, and exhibiting the same jog-trot outline system in design. Here we have at least some freshness of ideas and of mode of treatment,—a departure from the hackneyed track, into a better and more artist like one. Of course we can speak only as to general character of external design and style, for the perspective allows us to see only fronts of the two buildings distinctly, consequently we cannot undertake to say whether their character is satisfactorily kept up throughout: neither can we judge very accurately as to dimensions. The composition of the façade of the first-mentioned of the two designs, is quite Lombardic in outline and arrangement, being divided into three compartments, the centre one of which rises higher than the other two, and terminates in a gable, while the side ones are covered by half gables, not forming continuations of the principal one, but terminating lower down, before that commences. In each compartment is an arched recess or porch, containing—if we mistake not, a square headed door; and above the centre entrance is a large circular or rose window filled with two intersecting triangles, and bordered with coloured rays around its external margin. This polychrome effect is intended, we presume, to be produced by brick-work; and if so, we question if it will prove altogether so pleasing in execution as it does in the drawing, because in the latter it is particularly soft and delicate, whereas both the hue and texture of red brick, even when of superior quality, do not recommend as a material for ornament, however suitable it may be in certain styles, as a ground for embellishment in stone-work. Still though we have great doubts as to the result, we will not prejudge the experiment; on the contrary, we shall be glad to discover that our *misgivings* are *mistakings* also.

The church proposed for Paddington is similar to the other in style, but of a more ambitious character, being apparently considerably more extensive, unless the parts themselves are upon a smaller scale, and being surmounted by a cupola on an elevated tambour at the intersection of the transepts. Putting cost out of the question, it was most probably this latter circumstance, combined with the unusual and not particularly English physiognomy of the whole, that caused this design to be rejected incontinently. Perhaps, too, it may have been considered exceptionable as having too Roman Catholic a look,—for Catholicism happens to be just now one of the pet bug-bears of the day; just as if, while it is losing ground everywhere else, it is likely to gain ground in the land of John Bullism. We know not who is to be the architect of the church at Paddington,—have not, in fact learned if an ultimate decision is yet made, but the building will, we apprehend, not startle us by architectural innovations.

Turning from Mr. Wild's drawings to one for a similar purpose, No. 992, "The *approved* design for the New Church now about to be erected in the Liberty of the Rolls," we may tolerably plainly see what kind of things suit the taste and notions of those who are entrusted with the power of deciding on such occasions. That 'approved' does not exactly mean the most worthy to be approved, or carry with it an idea of superiority is evident enough—at least to ourselves, and in the present instance because we happen to have seen two other designs sent in for the same building, either of which was immeasurably better than this approved one; therefore it is a piece of good luck for it that neither of them are here exhibited, else we should most assuredly enter into some very 'odorous' comparisons. Perhaps, too, it is another piece of good luck for No. 992, that it is hung so high up as to be likely to escape notice altogether, unless the descriptive title in the catalogue should cause it to be hunted out.

No. 1034, Messrs. Buckler's "Design for the West Front of the Roman Church of St. George, Southwark," is in no danger of being passed by unnoticed, because the intense—and for this climate unnatural blue of the sky, renders it too conspicuous. As to the design itself, his front consists only of a very lofty tower in a style of Early Gothic, and although of good character, did not strike us as particularly novel or tasteful.

Nos. 1037 and 8, show us Mr. S. Smirke's design for the Reform Club House, in an elevation of the side towards Pall Mall, and a perspective view including that and the West end of the building, with its portico. Although merely said to be for "a Club House," there can be no doubt as to the particular one for which it was produced, both because it agrees with the description given of it in our first volume, (page 68), and as the Travellers' and Athenæum Club-houses are seen adjoining it. Most certainly it is not such as to make us regret that it was not preferred to Mr. Barry's, still we do not agree with the 'Art-Union,' which terms it "an ordinary Italian residence, with an ugly Corinthian portico tacked to the front of it." Now whether the epithet ordinary is to be understood as signifying 'usual,' or as expressive of both meanness and common-place character, we do not think it very correctly applied, because, although it may in some respects be in rather questionable taste,—we allude to the mullioned and transomed *croisées*,—it is more than ordinarily ornate, and is stamped by a good deal of picturesque quality. We prefer it greatly to the façade of the Oxford and Cambridge University Club-house, by the same architect, it being treated with more of artist-like feeling, and with greater consistency also. As regards the Corinthian tetrastyle of the West front, we do not pretend to say that it is particularly classical, but its effect in the composition is decidedly better than many of our soi-disant classical things of that kind which are tacked to buildings by no means so good as even "an ordinary Italian residence." Most decidedly too we prefer this to such a piece of architecture as No. 1045. "Design for the Taylor and Randolph building at Oxford," which as far as we can make it out where it hung, seems to us to evince neither originality of any kind, nor even study, both the composition and detail being exceedingly tame and common-place; yet we ought not to speak too peremptorily, because the 'Art-Union' critic tells us it possesses "much merit," further than which, said deponent sayeth nothing, but leaves others to find out, if they can, wherein it consists.

(To be continued.)

ON EXCHANGES.

WE present our readers with a brief sketch of a lecture delivered at the the last conversazione of the Architectural Society, by its President, William Tite, Esq., F.R.S., upon the subject of the origin and history of that class of buildings denominated "*Exchanges*;" a subject which has just claims not only to the attention of the public, in an empire of such commercial importance as our own, but more speficically so to the examination of every architectural student, in an age when both at home and abroad, the rapid progress of improvement may be reasonably expected to provide opportunities for the erection of Exchanges as well as palaces and churches.

In introducing his subject by a reference to the state of society in the most remote ages, Mr. Tite observed that the extensive commercial relations of such ancient cities as Tyre, and the vast conflux thereto of mercantile men from all quarters of the known world, render it a matter of little doubt that some place of public assemblage must have been allotted to their especial use. This seems rendered yet more probable, when we observe to what arrangements precisely similar circumstances gave rise, though at a later period, among the Greeks and Romans. It is clear that the αγορα of the former, and the forum of the latter were alike applied indifferently to various public purposes. Sometimes they were used for meetings of a commercial character, as well as for the ordinary purposes of the market place; sometimes for the administration of the laws, or the celebration of games and festivals; and sometimes for places of deliberation upon municipal affairs.

As the number, wealth, and employments of the inhabitants increased, it was found inconvenient to have so many occupations carried on together, and two classes of fora were established, viz. Venalia or market places, properly so called, and Civilia, or places of assembly, of which, however, there was but one until the time of Julius Cæsar. The Venalia were again divided into the Boarium or ox-market, the Piscarium, or fish-market, and the like. Something resembling this separation and improvement is to be traced in the history of the establishment of the English courts of law. The Saxon constitution comprehended but one superior court of justice in the kingdom, viz. the Great Council; but, after the Norman invasion, the ecclesiastical jurisdiction was separated from the civil, and the king subsequently effected another separation between the judicial and the parliamentary power, vested in the remaining members. He then established that very comprehensive court in his own residence, called "the King's Hall," composed of the great officers of state; which became at length divided into the different courts of Chancery, Exchequer, Common Pleas, and the Earl Marshall's court, or Court of Honour. The simple features of a Roman Forum appear at once to convey the image of a modern Exchange, it having been an open area surrounded by a colonnade, about which were subsequently established temples and prisons, courts and record offices, public granaries, offices of money changers, and a variety of trades, the municipal treasuries, and the rostra whence orators addressed the people. Some differences existed between the Greek and Roman Fora, derived from the different uses to which they were to be applied. Those of the Greeks were built square, with the columns near together, to afford as much shelter as possible; above which was an upper ambulatory or gallery for walking. The Roman fora, on the contrary, were oblong in the area, having the columns set at considerable intervals, but still surmounted by the gallery, in which latter feature, also, they somewhat resembled the Bourses of the 16th and 17th centuries. In those places which lay inland, the Forum was erected in the centre of the city, but in marine towns it was situated at the port. Accordingly the Piræus, or maritime town of Athens, was the principal place of commerce connected therewith, and it contained temples and theatres, arsenals, granaries and shops, and also the established place of assembly for merchants.

These circumstances are curiously illustrated by Theophrastus, in a description of the character of an ostentatious Athenian merchant, 'εν τῳ δειγματι 'εστηκως, and vaunting of his enterprise and wealth; in which description it is supposed by Casaubon and others, that the δειγμα expresses the place where samples of merchandize were produced and examined.

Down to this period, and most probably to a much later time, the places of assembly for merchants were to be found in the forum; and they appear to have generally occupied that interior extremity called the Basilica, for the choice of which, perhaps, Vitruvius gives one of the original reasons several centuries after, when he says, "the Basilica should be adjoining to the forum on the warmest side, that the merchants may confer together without being incommoded by the weather." Another cause for the selection might possibly be that they were there completely removed from the noise and confusion of the rest of the market or forum.

Livy also alludes to the formation of a "collegium mercatorum," in the fifth century before the Christian æra; but it may be doubted whether this phrase of itself can fairly be considered as proving any thing more than the existence of a "fraternity of merchants." It will be proper also to observe, before dismissing all notice of that period of remote antiquity, that there were certain secular points of view in which the Temple at Jerusalem may be taken as affording an illustration of this subject. The first Temple, it will be remembered, consisted of several square courts, surrounded by colonnades and chambers; and this building was an extended and greatly improved copy of the tabernacle, to which, therefore, may be referred the remote original of that extremely natural and convenient form for places of public assembly, which were subsequently to be found throughout the whole of the civilized world. When the corrupted traditions of the Hebrews led them to misemploy and profane the second temple, by making it a place of merchandize, the resemblance between the court of the Gentiles and a Roman Forum was very remarkable. After the conclusion of the feast of Purim, in commemoration of the triumph of Esther and Mordecai, the money-changers considered it lawful to seat themselves in the outer court, to exchange foreign coins for such as were current at Jerusalem; for the temple tribute, though collected in heathen money, was required to be paid in the shekels of the sanctuary, and several offerings also required the addition of parts of shekels to make them complete.

In this last circumstance, it will be shown hereafter, that there may be an especial parallel found to the facts that probably gave rise to the disignation of our own edifice of London. The court of the great temple at Mecca, as decribed by Sale, and many of the eastern Khans or Caravanserais will furnish some additional illustration of the forms of buildings applied in later ages and other climes to mixed purposes, not dissimilar to those under consideration.

From precedents such as these it may have been that the Venetians, in more modern times, but during the earlier ages of their republic, obtained a model for their great Exchange on the Island of the Rialto. It will be observed that this place of mercantile concourse was not the celebrated Bridge of the Rialto, as is usually imagined, but a portion of the Island of that name immediately adjacent to the Bridge. This island appears to have been the first inhabited among the many that now constitute the City of Venice; it became the centre of commerce, and the vast depository of the most valuable merchanize of all nations. As described by Sabellico in the year 1492, it appears that nothing was wanting to the completeness of this site, not only for mercantile, but for municipal purposes. The great place of meeting was a spacious quadrangular piazza, almost surrounding the church of St. Jacopo; and in its immediate vicinity were warehouses, banks, shops, markets, public offices, and halls of every description. The greater portion of these buildings was destroyed by fire in 1515, but was rebuilt, in a style of superior magnificence, during the following nine years, under the architectural superintendence of Antonio Scarpagni.

Passing by other Italian structures of inferior note, raised for the same objects, we shall find the example derived from them followed with conspicuous splendour in some of the cities of the Netherlands. To meet the rising commercial importance of Antwerp, at the beginning of the 16th century, a Bourse (according to the name introduced from Bruges), was erected in the year 1531. This structure is 180 feet in length by 140 in breadth, and is supported by 44 stone pillars, which are differently sculptured. It contains numerous subterranean warehouses, over which are the halls occupied by the tribunal and the chamber of commerce. It was not until nearly 40 years after this period that England possessed any similar building, during all which time the merchants were accustomed to assemble twice in each day, in the open air in Lombard-street. The king himself, however, so early as 1535, proposed that they shoald remove to the old edifice of Leadenhall, which they declined doing; and in 1537 Sir Richard Gresham laid before Thomas Cromwell, then Lord Privy Seal, the plan of a Bourse for London, in the old resort of Lombard-street, to which he had been probably incited by a visit to Antwerp. Before retiring from his Mayoralty in the following year. he made another effort to complete this design in a letter to Lord Cromwell, which is still extant. He states therein that "it will cost £2,000 and more," and at the same time shows the real cause why the work was not then and there carried into effect; since he adds, "there is certain houses in the said street belonging to Sir George Monnocks, and, except we may purchase them, the said Burse cannot be made. Wherefore, may it please your good lordship to move the King's Highness to have his most gracious letters directed to the said Sir George, willing, and also commanding him to cause the said houses to be sold to the Mayor and Commonalty of the City of London, for such prices as he did purchase them for, and that he fault not but to accomplish his gracious commandment. The letter must be sharply made, for he is of no gentle nature; and, that he shall give farther credence to the Mayor, I will deliver the letter, and handle him the best I may: and, if I may obtain to have the said houses, I doubt not but to gather £1,000 toward the building, or I depart out of mine office. There shall lack no good will in me."

The project which thus originated with Sir Richard Gresham, was realized by the liberality and enterprise of his son Sir Thomas, who commenced his edifice in London in the year 1566. The similarity which subsisted between this building and that of Antwerp, was very conspicuous. Like the latter, the Exchange of London had a tall tower placed on the east side of the principal entrance, containing a bell, which twice in the day summoned the merchants to assemble, at noon, and at six in the evening. In the interior of both we observe the same quadrangular arcade, carrying a similar upper story, and surmounted again by a high roof and regular gabled dormers of the same character. The Royal Exchange received its name on being opened in person by Queen Elizabeth, on the 23rd January, 1570-71.

There does not appear to have been assigned, either by contemporaneous or modern authority, any reason for the change of the name of this edifice by the Queen; though, from the very time of the proclamation, it seems to have been most effectual and complete. If, however, at this very distant date, a conjecture may be offered, it might have been a design of Elizabeth, which was never brought to maturity, to have re-established, in this building, the ancient exchange of the sovereigns of England, the former situation of which remains commemorated, even at the present day, in the street in Cheapside called *Old 'Change*. It was here that one of those ancient officers known as "the King's Exchangers" was placed, whose duty it was to attend to the supply of the Mints with bullion, to distribute the new coinages and to regulate the exchange of foreign coin. Of these officers there were anciently three, two in London, at the Tower and Old 'Change, and one in the city of Canterbury. Subsequently another was appointed with an establishment in Lombard Street, the ancient rendezvous of the merchants; and it appears not improbable that the Queen's intention was to have removed this functionary to what was now pre-eminently designated as the Royal Exchange.

As the Bourse of Antwerp had furnished a model for close imitation to the projectors of London, the work of the latter was, in its turn, closely followed by the citizens of Amsterdam. The Bourse, which still subsists there, was commenced in 1608, and opened in 1613. A rectangular area, as in the previous instances, is surrounded by a covered way, formed by forty columns of stone, carrying an upper story and roof exceedingly similar to those before noticed. There are principal entrances on the north and south sides, and the latter has the addition of a lofty bell-tower and clock.

To revert to the Royal Exchange of London, it may be noticed that, the original structure having been destroyed in the great fire of 1666, its successor was erected upon the same site, under the superintendence of Mr. Edward Jerman, one of the surveyors to the city, at an outlay of £58,962. With the facts affecting the recent destruction of this edifice by fire also, we are all too well acquainted; and with respect to the erection of any structure that may supply its place, it may be sufficient just to state, in conclusion, that the instructions under which the various designs for a new Royal Exchange have been prepared, have determined that an open area shall be preserved for the use of the merchants, after the manner of the former building, but about one third larger in extent. The Bourse at Paris, the more recently erected Exchange at Glasgow, and the Exchange at St. Petersburg, are all covered buildings. The Exchange at Liverpool, on the other hand, follows the more ancient precedent, retaining the open area and surrounding arcade. As any discussion of the propriety of those instructions that have been issued for the direction of architects on the subject of the new Royal Exchange, would be beside our present purpose, as would any observations in anticipation of a future structure, we may now close our remarks, with a hope that this compressed statement may afford our readers some degree of that interest with which the original lecture was received by the audience of the Architectural Society.

THE ROYAL EXCHANGE.

Sir—Having taken no part whatever in the competition, or in any of the correspondences which have appeared in the various public prints relative to the Royal Exchange, and feeling a general disgust at the intemperate manner in which such correspondences are usually conducted, but understanding that the affair appears as far off from settlement as ever, I now crave through the medium of your widely circulated journal, the promulgation of the following brief remarks.

1st. It appears pretty certain, that the plan which will be adopted will conform, as it should, to the lines of the principal adjoining streets, otherwise the frontages of the building would lie awkwardly with regard to them, and more ground would be given up in making the site rectangular than the required accommodation would well allow. It seems therefore that the plan will be in shape a trapezium.

2nd. In all plans of this shape which I have seen, (that of Mr. Tite included), there are a multitude of irregularities, many rooms out of square, some of the largest of them with whole wings sliced off irregularly, and many doors, windows, and chimneys seemingly placed at random, all which defects would be evident enough to those who might use such apartments.

3rd. Now I would undertake to make such a design (merely by remembering that there is in the world such an art as Geometry, of which Wren, and his kind, made much use, more especially in difficult cases), which design should have every internal apartment, angle, door, window, and chimney regular.

4th. To effect this, I should need only to cut off from the site, the large ranges of apartments in lines exactly parallel to the principal front of the building. This would leave a smaller trapezium in the centre of the ground.

5th. Within this smaller trapezium I should place an elliptical court, and in the four spandrel spaces which would be left, I should place semi-circular staircases, water-closets, and other offices.

6th. The architecture of the elliptical court, I should form something after Inigo Jones's magnificent and universally admired circular Persian court, designed for Whitehall: but instead of having all the culumnar statues (say 32 in number) made similar, which by monotony would displease, I would have them each a type of some chief nation trading to London: and if the expense of these Caryatic statues be objected to, I doubt not that the merchants engaged in the several trades, would find the difference between the price of them and of plain piers.

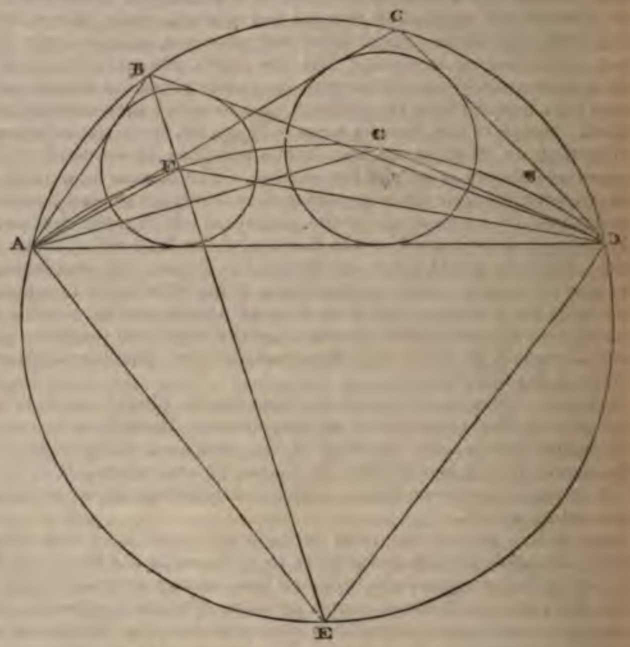
I am, Sir, your very obedient humble servant,

Gray's Inn, June 19, 1840. B.

GEOMETRICAL THEOREM.

Sir—I believe that the following curious property of a circle has not hitherto been noticed; or if it has, I am not aware of its existence in any of our works on Geometry.

Let A B C D E be a circle, of which A C D is any given segment: Let any number of triangles A B D, A C D, &c. be drawn in this segment, and let circles be inscribed in these triangles: their centres F, G, &c. are in the arc of a circle, whose centre is at E, the middle of the arc of the opposite segment A E D.



DEMONSTRATION.

Join A F, F D, A G, G D; then since F is the centre of the circle, inscribed in the triangle A B D, the lines A F, F D, bisect the angles B A D, B D A. (Euc. B. 4, P. 4). For a like reason A G, G D, bisect the angles C A D. C D A; hence the angles F A D, F D A, together, are equal to half the angles, B A D, B D A together, and the angles G A D, G D A together, to half the angles C A D, C D A together. Now the angles A B D, A C D, are equal (being in the same segment), therefore the angles B A D, B D A together, are equal to the angles C A D, C D A together, and as the halves of equals are equal, the angles F A D, F D A together are equal to the angles G A D, G D A together; that is in the two triangles A F D, A G D, two angles of the one, are together equal to two angles of the other, and therefore the third angle A F D, is equal to the third angle A G D. The same reasoning will prove, that all angles similarly circumstanced to A F D, are also equal to A G D: therefore, the points A, F, G, D, are in an arc of a circle.

Join B F, and produce it to cut the opposite circumference in E and join E A, E D; then because the angle A B E, is equal to the angle D B E, the segment A E, is equal to the segment E D, and the chord A E, to the chord E D. Again the angles A B E, E D A, are equal (being in the same segment), and by construction, the angle A D F is equal to the angle F D B, therefore the whole angle E D F, is equal to the two A B F, F D B, that is to the two F B D, F D B, that is to the exterior angle E F D; therefore the angle E F D, is equal to the angle E D F; consequently E F, is equal to E D, that is to E A. The same reasoning would prove E F to be equal to a line drawn from G, to the point E. Wherefore the point E is the centre of a circle, of which F and G, as also the centres of all other circles similarly inscribed, are in the circumference.

H. Spencer.

Birmingham and Gloucester
Railway Office, Worcester.

CANDIDUS'S NOTE-BOOK.

FASCICULUS XVI.

> "I must have liberty
> Withal, as large a charter as the winds,
> To blow on whom I please."

I. A friend of mine is in the habit of exclaiming "Damn all Dictionary-makers," and I am tempted to say ditto as regards all illustrators, a set of illuminati who generally display their cleverness by leaving you as much in the dark as possible. Would it be believed that one of these 'picturesque' geniusses, who visited St. Petersburg 'expressly' for the purpose of taking views of the most striking buildings in that capital, actually turned his back upon the portico and dome of the Kazon Church, and brought into his view of that edifice merely an angle of one of the sweeping colonnades! Hogarth's sketch of a serjeant and dog entering an ale-house, which group he exhibited in three strokes of his pencil, might be taken as a satirical quiz upon such shamming illustrations. What then is to be said of Soane who has actually omitted in his 'Designs of Public and Private Buildings,' what is by very far the best piece of exterior architecture he ever produced—namely, the little semicircular loggia at the north-west angle of the Bank!! It is indeed just discernable in a coarse scratch of the general elevation barely an inch in height; but from the peculiarity of its plan, such a piece of design required to be explained by elevations, sections, &c. on as large a scale as the size of the plates would admit, which would have been about half an inch to a foot. That I am not singular in my opinion as to the merits of that piece of architecture is evident, because it was selected as the subject of the medal presented to him by the Institute. Such an extraordinary omission induces me to imagine that Sir John's wits were *benighted* quite as much as himself;—at all events he seems to have been resolved that the purchasers of his work should be left quite in the dark with respect to the subject alluded to. Poor man! he was not deficient in cunning, and had just enough to outwit himself, one notorious instance of which is his singular donation of his house, by which he has bamboozled the public, but damned his own character for munificence, into the bargain.

II. Conversing the other day with ——— (who has a greater reputation for wit than for sanctity) on the subject of the present fashion —style I will not call it, in church building, I remarked that Welby Pugin was after all tolerably right in some respects, and that the practice of enclosing the congregation in separate pews was an insuperable disadvantage in an architectural point of view, besides which it seemed to me objectionable as carrying wordly distinctions and the principle of *meum* and *teum* into the very House of God. "As regards architectural effect," replied ———, "you are certainly right,—in your other objection as certainly wrong. Do you not perceive the symbolic propriety and expressive meaning of the very things you find fault with."—"I really do not." "Why then, my good friend, you must have grown quite muddy-headed.—What!—do you not at once see the striking propriety—the analogical and practical illustration of Gospel, in putting the pastor into his pulpit, and his *flock* into *sheep-pens?*"

III. "It is most deplorable and paltry," observes Prince Puckler-Muskau, "when, instead of being expunged and corrected, a particular part which is evidently a failure, is allowed to remain a blemish to the whole work, merely because it has cost so much time and money, and the requisite alteration would cost so much more." Although the writer is here speaking of Landscape-gardening, the remark is equally applicable to architecture, many productions of which, might be greatly improved by amendments that are almost self-evident. It is true, there ought never to be any occasion for improvement of such kind, because every part and feature of a building may be, and invariably ought to be, thoroughly studied and foreseen from the designs for it.

IV. Earnestly is it to be wished that architects would endeavour to emulate the other sex in the devoted application of all their faculties, which those exemplary and most truly *con amore* artists bestow upon their handy-works. When I perceive on the one hand with what plodding indifference, hurry, or carelessness, many buildings have been designed; and on the other, what anxious thought, what patience, what contrivance, what ingenuity, what scheming and planning, and how much consultation, are given to devise a ball dress—as if it were a work destined to outlive the eternal pyramids;—when I perceive with what critical study and exactness every part of the fabric is elaborated, and that as much attention is paid to the precise quality and texture of the material, as if all men were men-milliners and able to tell at a glance where a lady's lace and velvet have been manufactured, or what they cost per yard;—when I see and perceive all this, I cannot help drawing a comparison that is greatly to the disadvantage of us 'male creatures,' especially of some of those who call themselves architects. What hurried, slovenly, and slobbered work do they make of it! in what coarse, ill-assorted, and awkwardly put on finery do they attempt to dress up their designs,—to say nothing of the grotesque mixture of arrant shabbiness and such finery which they so frequently parade before our eyes in the most ridiculous manner. We men are dull pedants who judge only by rules, while women are guided by a refined tact, an unerring delicacy of instinct, which preserve them from committing those gross solecisms in taste into which we are perpetually falling: let us therefore cry out *Place aux Dames!* for they deserve to take precedence of all the Old Women in Breeches, who bore us with their Vitruvius, and their Palladio.

V. Lindley Murray would go just as far towards making a poet, as the writings of Vitruvius, Palladio, *et hoc genus omne*, towards forming an architect who should also rank as an artist in his profession. For what are that class of architectural writers more than mere *grammatici*, —useful as furnishing the rudiments and implements of study, and nothing further? But it would seem that in architecture mere grammatical accuracy is held to be everything,—the ideas, the combinations, the conception, the composition—effect, character, expression, comparatively nothing,—what may be left to chance; because, provided no sins be committed against the petty rules of the art, be it as intolerably dull as it may, the work is certain of being recognized as legitimate and orthodox. Such being the case, and negative merit being accepted as possitive—nay as something wonderful, nothing short of a prodigious achievement in art, can we at all wonder at beholding so many sickly insipidities displaying themselves in stone or cement? or such pieces of architectural bathos, as the British Insurance Office, where Agrigentum columns ,shop windows, crooked balconies, figures of sprawling drunken ladies, &c., are all jumbled and squeezed up together. If the author of that monstrosity be still living, with what a shudder must he be seized every time he passes by it,—unless his nerves should happen to be of iron, and his scull well fortified with lead. However he has certainly given, at his own cost, an excellent lesson *pro bono publico* to the profession, showing them very forcibly what they ought to avoid.

VI. It was the opinion of that exceedingly sensible, but most horrible unsentimental person, Dr. Johnson, that "marriages would in general be as happy and often more so, if they were all made by the Lord Chancellor;"—which, by the bye, would be a complete death blow to the novelists:—and I myself am sometimes inclined to adopt a similar opinion with respect to architectural competitions, and say that in nine cases out of ten, the choice would prove as good were it left to the Lord Chancellor, or the—Lord Mayor. Seldom could their decision prove a worse one than what now frequently occurs; not often would it be so bad, because ignoramus as he might be, a Lord Mayor, would as an individual feel obliged to pay some deference to public opinion; whereas a committee can afford to brave it, since whatever may be the odium that falls upon it as a body, no member of it feels in his own person. As to the Lord Chancellor, however, I should be loth to commit the task of decision to him, because expedition and promptitude are not to be looked for in that quarter. In fact, the Royal Exchange does seem to have been actually put into *Chancery;* for after the lapse of two years and a half the foundations of a new structure are not yet laid, although the space of a single twelvemonth sufficed to rebuild, and refurnish the Winter Palace at St. Petersburg, an edifice three or four times the size of the one intended to be reared in Cornhill. The British Museum also goes on at the true Chancery pace,—*ditto* the Nelson Monument that is to be. Nay, if the truth may be told, Competition itself is a sort of *Chancery*, mere chance having quite as much to do with the decisions, as either judgement or taste.

VII. I incline to the opinion of Mr. Walter Fisher, when he says: "The real truth is, I feel mortified at being kept down by a want of ardour in our patrons. We hear a great deal of Scott and Southey, and Byron, and Wordsworth; and folks talk of Lawrence and Reynolds,—and all the rest of it; but what is poetry of which not one person in ten thousand can judge—to Cookery?" When I say I incline to Walter's opinion,—who, by the bye, if he does not lack conceit has an equal stock of enthusiasm.—I do not mean that I form precisely the same comparative estimate of poetry, painting, and cookery as he does, but merely agree with him that for one who can judge of poetry, there are ten thousand who can judge of and relish cookery; and that there are ten times ten thousand who are most unaffectedly devoted to the latter, for who is passionately addicted to—architecture.

It is invidious to scrutinize motives too narrowly, but I have certain uncomfortable misgivings, that lead me to fancy architecture would have still fewer votaries were it not for the attractions of cookery. If the reader be so obtuse as to ask for further elucidation, I can only pity—not assist him, because it would be impossible for me to explain myself more clearly without becoming libellous, and forfeiting that character for indulgent clemency, and considerate forbearance which I have now established.—*Au reste*, it would be amusing if not edifying to draw a parallel between architecture and cookery, which latter of these two fine arts requires a peculiar genius for combinations, *combinations-geist*, generally dispensed with by the other. At all events it cannot be denied that architects do show themselves less expert than our *chefs-de-cuisine*, for they seldom do more than merely *hash up* afresh the same stale remains of classicality.

FRESCO PAINTING IN ENGLAND.

THE DUKE OF BEAUFORT'S MANSION.

We have several times alluded to the works going on at Beaufort House, but have not until now been able to give our readers any detailed account. We may remark that this mansion is situated in Arlington Street, Piccadilly, having, from the back, a view of the Green Park. It was formerly in the occupation of the Marquis of Camden, but is now being fitted up by the Duke of Beaufort as a town residence. His grace had certainly some difficulties to contend with in the previous state of the house, which, like too many other mansions in London, had been consigned to the tasteful hands of the upholsterer and the whitewasher. It being considered that painting might look as well on the walls as dabbed and spotted paper, a point on which we fear there are some doubts entertained by London residents generally, it was originally suggested, under the idea that Englishmen could not do it so cheaply and so well, that German artists should be employed. While the negociations were going on, Mr. Latilla was mentioned to the Duke as having been engaged in similar works, and having been directed to send in designs, was immediately employed. By this arrangement the work has not only been done much cheaper, and we think many will consider better, but a great service has been rendered to English art. Mr. Latilla's system of fresco painting had already met with much approbation and encouragement, but it wanted this excellent opportunity to display its powers more fully.

Passing on now to the works executed under Mr. Latilla's direction, the first is a vaulted corridor leading from the entrance hall, and which, in the Marquis of Camden's time, remained in all the simplicity of white and unpolluted paint, but is now designed in bigio or chiar' oscuro with trophies and medallions, something in the Roman style. On the side opposite the windows a range of plaster statues of agricultural divinities bear lights in their hands, and serve to break the view. At the end of this corridor is a hall from which a staircase runs to the upper apartments; the walls and ceiling of this staircase have also been decorated with representations of medallions and architectural ornaments.

On the ground floor are the principal apartments, one of which, the banquetting room, we are now about to describe. This apartment may be about thirty feet by twenty, and sixteen feet high, having on one of the long sides three windows, the opposite side an entrance door, another and a chimney at one end of the room, and at the other end folding doors leading out of it. Six large panels are thus left, which are painted with two series of subjects, one representing the seasons, and the other Hebe and Ariadne. As a banquetting room the decorations of course are of a Bacchanalian character, and without departing from the character of the antique, are not repulsive to modern taste. The whole style is a similar happy adaptation of ancient principles, and without being restricted to any one school, has a unity of character which establishes it as a style in itself. The design of the panels is much in the Pompeian taste, but carried out in accordance with the advance of modern art; the pilasters and arabesques have, perhaps, more of the character of Girolamo Romanino, or his model, the baths of Titus, and the tone of colouring shows a nearer approach to the Herculanean than the Pompeian. The ground of the room is of a lavender colour, and upon this a brightness and harmony of effect is produced without spottiness or rawness.

The two panels at each end of the room are devoted to the seasons, the first of which, Spring, is represented by a female figure clothed in white gauze, and floating in true antique style in ambient air. Beneath her is a landscape representing Greek scenery, and under the panel is a mask of a young head in a festoon of spring flowers, daffodils, crocuses, snow-drops, &c.

The next on the same side is Summer, also personated by a young female, crowned with a wreath of roses, and holding a garland in her hand, and floating over scenery representing Egyptian subjects. The festoon underneath is of roses and other summer flowers, and contains a mask of Baccnus.

At the opposite end of the room, the figure next the door, that of an older female, is the emblem of Autumn; she is crowned with poppies, and presides over an autumnal landscape. A mask of a warrior reposes on a festoon of grapes, wheat-ears, and other harvest productions. Part of the drapery of this is, perhaps, a little heavy.

The remaining panel of this series is devoted to Winter, a subject treated in a beautiful and effective method. In a deep blue winter sky floats a young female closely draped, with part of her robe brought round her head as a hood. Above her head is seen the constellation of the Pleiades, and to her breasts she clasps a cinerary urn, the emblem of the closing year. Underneath is a representation of iceclad mountains, forming an appropriate finish to this admirable scene, the character of which is indeed well maintained. A mask of a bearded old man is placed on the festoon beneath, which is twined of the holly and mistletoe and other emblems of Christmas.

The other and smaller series of subjects is on the side opposite the windows. One panel is appropriated to Hebe, who, with her golden vase and cup, and usual attributes, flies over a morning scene. The other panel represents Ariadne with the thyrsus, the scene under being a sacrifice to Bacchus. Under each of these panels is a festoon of flowers with a mask of a female head.

There is nothing much to remark in the smaller doors, they have over them each a small panel, containing a vase and flowers. The ornaments of the folding doors consisting of bluish ribbands and of medallions, have much of the character of the baths of Titus, and over the door is an arabesque on a yellow ground. The treatment of these doors is very skilful, the details made to tell well. The chimney and fire-place is of black marble with ormolu ornaments, and over it is a large glass. This chimney it was very difficult to bring in, but the treatment has been most successful. Over the glass is a deep chocolate ground panel, with boys carrying grapes, accompanying an infant Bacchus riding on a goat. The several compartments of the room are divided by arabesques, consisting of a red staff or thyrsus, with grapes and Bacchanalian emblems. The carving round the room has four corners of a peculiar deep brown used by the ancients, which Mr. Latilla names Etruscan brown. Between these are arabesques on a cream-coloured ground, consisting of boys playing with panthers. The ceiling is of a low cream colour, having in the centre a patera, formed of light festoons and flowers. From this depends a lamp ornamented with vine leaves of ormolu, and grapes of ground glass. The carpet is of a plain pattern, and light in appearance; it is of blue and yellow on a maroon ground, with a white border. The furniture is of the simplest description, a mahogany table and red morocco chairs. These latter accessories are not of the selection of the artist, but it does great credit to the high-minded nobleman who employed him, that he has not, as is too often the case, allowed the furniture to injure the rest of the works. The lamp might have been more in the antique, but it is not offensive. An Elizabethan stove, intended to have been placed in the room, has been removed.

An oval saloon leading from the banquetting room to the drawing room is also painted by Mr. Latilla. It has a white ground with festoons of gold ribband, but we cannot say we like the design of these last. The drawing room is now under the hands of Mr. Jones, (the author, we believe, of the work on the Alhambra.) The design is in a style somewhat of the time of Henry the Fourth, and is of a most gorgeous character, nearly all gold and silver. The panels represent the story of Mary, Queen of Scots, and the walls are of a bright blue, with fleur-de-lis. The effect is admirable, but there are few, we believe, who will not prefer the light elegance of the banquetting room, which both by night and by day is equally effective.

The Duke of Beaufort has reason to congratulate himself on his determination in every respect; his banquetting room has been executed for a tenth part of the German estimate, will remain for centuries, and would be injured by any but the simplest furniture. As a worthy encouragement of English art and an example to other patrons, Beaufort House and its noble owner have done much valuable service, and we shall be greatly deceived if its results are limited to such a sphere, or confined to the employment of one man. We see, in this mansion, the germ of what can be done in our national and civic edifices, and architects and artists will do but half their duty if they do not agitate until in this line, also, we have distanced foreign rivalry. We have enough artists of fame in the country, we have plenty of latent talent, and it wants but scope for exertion to place us in that position which Englishmen, if they have the opportunity, are sure to attain. For three hundred years we fostered foreign art, and the result was that we did not produce even one good artist for every foreigner employed; we got only Hudson, Oliver, and Thornhill, in exchange for Holbein, Rubens, Vandyke and Lely: we began to depend on our own resources, and we have produced men whose names are known to Europe; in all the branches of art for which we have scope, we have made our way, and in despite of want of instruction, want of taste, and want of encouragement, at any rate we have shown that we can produce high art, if it be but called for. The barbarians who could add whitewashed garrets to the British Museum, are but a portion of the great body of Midases in art, who, by indifference or opposition, check its encouragement by the legislature, and although they have begun to find out that whitewash is not the best back-ground for the Elgin marbles, yet they and their brethren must go a step further, if they wish England to make a good figure in the eyes of its neighbours. There is the British Museum, National Gallery, and Royal Exchange to go to work upon, and above all, the new Houses of Parliament; rich as they are in historical associations, they lose half their value without even a mark to tell the scene of so many great events, where the sovereigns of a mighty empire have been created and deposed, tried and executed, where viceroys and ministers have been arraigned, the destiny of the old world and the new determined, kings made tributary, and slaves set free.

We must by this time have made known the high sense which we entertain of the talents and exertions of Mr. Latilla, and we are disposed to look less at his past works, than to dwell upon the hope of those which are to come. Even since his labours at Beaufort House, he has in Italy acquired fresh power and confidence in his art, and his course of instruction has been such as well to fit him for a higher task. For many years he has devoted himself to fresco painting, and the history of his initiation, which we have heard, is a good lesson of the value that may attach to what we too often despise as trifles. John Nash, the architect, brought home from Italy a collection of designs from the Loggie of the Vatican and some Italian artists, whom he employed to paint part of his house in the Raffaelesque style, and Latilla, then a boy, was employed in finishing it after they left, when he was so struck by what he saw, that from that day he devoted himself to fresco, and exerted himself for its introduction.

PUBLIC BUILDINGS IN LONDON.

A Critical Review of the Public Buildings, Statues and Ornaments in and about London and Westminster—1734.

BY RALPH.

(*Continued from page* 201.)

The grand cathedral of St. Paul's is undoubtedly one of the most magnificent modern buildings in Europe; all the parts of which it is composed are superlatively beautiful and noble; the north and south fronts in particular are very perfect pieces of architecture, neither ought the east to go without due applause. The two spires at the west end are in a finished taste, and the portico with the ascent, and the dome that rises in the centre of the whole, afford a very august and surprizing prospect; but still, with all these beauties, it has certainly yet more defects; and the pleasure we receive from the first is so much qualified and tamed by the last, that we rather wonder how we can be pleased so much, than why we are displeased at all. But not to condemn in the gross, I will take the liberty to touch upon a few particulars, and lay myself justly open to censure, in case I mistake, or blame in the wrong place.

In the first place therefore, there is a most notorious deficiency in point of view; such a huge fabric as St. Paul's ought at least to be surveyed at the distance of Temple-bar, and the vista ought to be considerably wider than the front of the building. But this is so far from the case here, that we cannot see it till we are upon it, and this defect is still made worse by turning the edifice from the eye even where it can be viewed, for the sake of that ridiculous superstition of erecting it due east and west. In the next place, the dividing the portico, and indeed the whole structure into two stories on the outside, certainly indicates a like division within: a circumstance abounding with absurdities, and defeating even the very end of erecting it at all. If indeed the architect had been embarrassed to reconcile the distance and height of his columns, I am humbly of opinion that a light and proper attic story had answered all ends both of use and beauty, and left him room to have enlarged his imagination, and have given an air of majesty to the whole: let me add that I apprehend the portico should have been farther projected on the eye, instead of retreating from it, in order to have given a grand contrast to the whole front, and aided the perspective within.

I shall say no more on the outside than this, that according to my best notions of regularity and order, the dome should have been raised exactly in the centre of the whole, and that there should have been two corresponding steeples at the east as well as the west end, with all other suitable decorations; if a view of the whole length of the building, too, could have been opened to the water-side, it would have added greatly to its grandeur and magnificence, and have afforded a most noble prospect from off the river into the bargain. However odd or new the first of these propositions may seem, let any body take a view of St. Paul's from any of the neighbouring hills, and they will instantly discern that the building is defective, and that the form of a cross is more favourable to superstition than beauty; in a word, they will easily see at least, that the dome, in its present circumstance, is abundantly too big for the rest of the pile, and that the west end has no rational pretence to finer and more splendid decorations than the east.

Before we begin our examination of the inside of St. Paul's, it will not be amiss to cast an eye on the statue in the area before it, erected in honour of the late queen. It stands exactly in the front of the building, though it seems, by the odd situation of Ludgate Street, to be on one side, and is, upon the whole, modelled in a tolerable taste, and executed as well; the principal figure, indeed, the queen herself, is an exception to this character; such a formal Gothic habit, and stiff, affected attitude, are neither to be endured or pardoned, and there is not one of those round the base that does not justly deserve the preference.

Whoever understands the nature of public ornamental buildings critically, always lays it down for a rule, that they cannot be too expensive or magnificent; for which reason St. Paul's is so far from being admired for being so grand and august as it is, that nothing is more common than to hear it censured for not being more so. Every body knows that the fund which raised it from its ruins to its present glory, was equal to any design of beauty or majesty; and as those who had it in trust went so far towards this necessary end, it is a thousand pities they did not carry it on much farther, and make this pile not only the ornament of Britain, but the admiration and envy of all Europe. St. Peter's at Rome was already built; a model which the most finished architect need not have been ashamed to imitate, and as all its particular beauties have been long publicly known and admired, I think it was incumbent on us to have equalled it at least; and if we had excelled it too, it would have been no more than might have been reasonably expected from such a nation as ours, and such a genius as Wren.

On these principles it is that men of taste and understanding are surprized, at entering this church, to see so many faults, and miss so many beauties; they discover at once that it wants elevation to give it a proportionable grandeur, and length to assist the perspective; that the columns are heavy and clumsy to a prodigious degree, and rather incumber the prospect than enrich it with symmetry and beauty; half the necessary breaks of light and shadow are hereby wanting, and half the perspective in general cut off; at the same time I do not deny but many parts of the decoration are exceedingly grand and noble, and demand very justly a sincere applause. The dome is, without question, a very stupendous fabric, and strikes the eye with an astonishing pleasure; it is, indeed, one of those happy kinds of building that please all kinds of people alike, from the most ignorant clown up to the most accomplished gentleman; but yet even here the judge cannot help taking notice that it bears no proportion to the rest of the building, and that after you have seen this, you can look at no other part of it; whereas a judicious builder would husband his imagination, and still have something in reserve to delight the mind, though nothing perhaps could be contrived to surprize after it.

For example, the very nature of a choir would not admit of any thing so marvellous as the dome, yet it might have relieved the eye with something equivalently beautiful; the entrance in front might have been more noble and uniform, either composed of wood entirely or marble, for the present mixture of both makes a disagreeable piece of patch-work, that rather disgusts than entertains; the opening on the inside, through the present beautiful range of stalls, might have terminated in a much more magnificent alcove than we see there at present, adorned with all the elegance and profusion of decoration; the altar should have been raised of the richest marble in the most expensive taste, that it might have been of a piece with the rest of the church, and terminated the view of the whole, with all the graces of the most luxuriant imagination. All the intermediate spaces should have been filled up with the noblest historical paintings; all the majesty of frieze-work, cornices, and carving, heightened with the most costly gildings, should have been lavished to adorn it, and one grand flow of magnificent curtain, depended from the windows, to finish and adorn the same.

Thus have I been free enough to give my impartial opinion of St. Paul's; I hope not too presumptuously, and if ignorantly, let every reader's private judgment set me right.

St. Andrew's Holborn, has the advantage of a very good situation, but then it deserves it as little as any modern church in the whole city. The tower is even below criticism, but the inside of the building makes amends for the awkwardness of the out; and is really as neat and well-finished as the manner and taste it is formed in will allow.

Temple Bar is, indeed, the handsomest gate about town, and deserves some degree of applause; if it has any fault, it is this, that the top being round as well as the arch underneath, the whole wants that contrast of figure which is so essential to beauty and taste. The statues on the outside are good, their only disadvantage is the hurry of the place where they are to be viewed, which makes it dangerous to be curious, and prevents the attention to them which they would otherwise command.

The structure of the Temple Gate is in the style of Inigo Jones, and very far from inelegant. I wish I could say the same of the different detachments of building which belong to it, but that is far from being in my power, nor ever can or will; the property is so divided and subdivided, that it is next to impossible that any agreement should ever be made in favour of harmony and decoration. It is certain that nothing can be finer situated than the Temple, along the side of the river, and if we consider the elevation of the ground, and how far it extends, the most barren invention cannot fail of conceiving the uses it might be put to, and the beauties it would admit of. At present there is but one thing which is worth observing in the Temple, and that is the old church which belonged to the Knights Templars of Jerusalem; and the outside even of this is covered from the view, that the whole might be of a piece. The inside indeed is yet visible, and may justly be esteemed one of the best remains of Gothic architecture in this city. The form of it is very singular; you enter first into a large circular tower, which at top terminates in something like a dome, and has a very good effect on the eye; beyond, opposite to the entrance, the church extends itself in three aisles, and is built and finished with as much elegancy and proportion as the taste of those days would allow.

From the Temple it is but a natural step to Lincoln's Inn; but, by the way, it is worth a stranger's curiosity to visit the habitation of the Master of the Rolls, which is certainly built with elegancy and convenience, and can be blamed in nothing but its situation, which is undoubtedly as bad as the building itself is good.

Lincoln's Inn may reasonably boast of one of the neatest squares in town; and though it is imperfect on one side, yet that very defect produces a beauty, by giving a prospect to the gardens, which fill the space to abundantly more advantage. I may safely add, that no area any where is kept in better order, either for cleanliness and beauty by day, or illuminations and decorum by night; the fountain in the middle is a very pretty decoration, and if it was still kept playing, as it was some years ago, it would preserve its name with more propriety, and give greater pleasure into the bargain.

The outside of the chapel belonging to this society, is a very good piece of Gothic architecture, and the painting on the windows has a great many admirers within; in my opinion, indeed, it does not deserve quite so much applause as it has received, because the designs are poor, the faces have little expression, and there is little reason, beside a blind regard to antiquity, to extol them at all. The raising this chapel on pillars affords a pleasing, melancholy walk underneath, and by night particularly, when, illuminated by the lamps, it has an effect that may be felt, but not described.

The gardens are far from being admirable, but then they are convenient; and considering their situation, cannot be esteemed too much. There is something hospitable, too, in laying them open to public use; and while we share in their pleasures, we have no title to arraign their taste.

As I find my business increase upon my hands, as I come nearer the polite end of the town, I shall be obliged to divide it into three distinct walks, that it may appear in something like method, and be a better guide to the stranger, or man of taste and curiosity; in the first I propose to go from Lincoln's Inn Fields to the end of Piccadilly; in the second from Temple Bar to Westminster; and in the last from Gray's Inn to Grosvenor Square.

(To be continued.)

CATHOLIC CHAPELS—MR. PUGIN.

Sir—Your correspondent P. S. (as well as some other contributors to your Journal), evinces what appears to me to be a very needless jealousy of the name of "Pugin," and appears to wish to throw discredit upon the statement of the "Argus," that no fewer than seventeen Catholic Chapels are being erected under that architect. Mr. Pugin has certainly done much to excite the jealousy and spleen of Protestant architects, by the severe rubbing up which he has given us; but would it not be better for us to endeavour to learn wisdom from our enemy, (if he is such), than to content ourselves by showing our spleen at every mention of his name? Would it not be more prudent and more creditable for us to eradicate the errors of taste which he has so mercilessly exposed, rather than to bolster ourselves up with the idea that his lampoons are undeserved, or that he is himself equally open to attack? There can be no reasonable doubt of the fallacy of Mr. Pugin's theory that every architectural vice took its rise among the Protestants, and that every merit belongs to the Romanists; there can be no question that though the "Gothic" styles were invented and brought to perfection among the Catholics, they were also first *relinquished* by the Catholics, and (in modern times) first revived by the Protestants. There can be no doubt that Mr. Pugin himself imbibed his taste for these styles while a Protestant, and that he has since been the first to impart this taste to the Catholics, who had previously (in our times) evinced little or no taste for the works of their forefathers—so that this theory of Mr. Pugin's evidently falls to the ground. This, however, so far from vindicating Protestant architects from the charge of bad taste, removes the excuse which even Mr. Pugin made for them. Mr. Pugin's equally severe, and more just criticisms on the modern Catholic Chapels, have been so well received, that we immediately find chapels starting up in every part of the kingdom, in the purest taste, and many of them on a scale of magnificence which would not have disgraced the best ages of Christian architecture. It now remains for Protestant architects to display their zeal and their talents in a similar manner, and to give practical proof that they have been unjustly handled, rather than to attempt a petty revenge by detracting from the merits of a rival, who with all his eccentricities, is beyond comparison the first Ecclesiastical Architect of the day.

I am, Sir, your most obedient servant,
A Protestant Architect.

London, June 10, 1840.

P.S.—Among the Catholic "Churches" or Chapels I have seen or heard of as being erected, or about to be erected by Mr. Pugin, are those at Derby, Birmingham, Manchester, Keighley, Whitby, Dudley, Reading, at or near Worksop, St. George's Fields, &c., as I have only accidentally seen or heard of these, and have forgotten many more I have heard of, I have no doubt that the number exceeds that named in the "Argus."

ON THE HORIZONTAL AND PERPENDICULAR LINE IN ARCHITECTURE.

By Frederick East, M.A.

(Concluded from page 187.*)*

I had intended with submission to any opinions current amongst professional disquisitors upon the subject of horizontal and perpendicular lines, to have included in the pourtrayal of that matter, a few remarks upon the subject of broken entablatures, so often noticed in a critical way, by the jealous guardian of consistency in classical architecture. Avoiding, however, any further intrusion into the columns of last month's Journal, than the subject *actually* required, I reserved that privilege for the next, and in offering a few opinions upon so interesting a theme, do so with the idea that as this breaking of the cornice is one of the peculiarities of the Palladian school—and of perpendicular Italian; there is a natural link between it and the subject of my last paper, namely, lines.

Some conceive the fashion for breaks, an Italian prejudice discordant with the harmony of correct art, and generally condemn their use as unwarrantable and unmeaning. Others again, in the warmth of their attachment for certain masters, would follow them into every caprice of taste, and find their very eccentricities engaging. I humbly conceive nevertheless, that we cannot employ these breaks, frequently, nor perhaps at all, if the imagination is to be *vigorously* affected,—or if the building, whether in plan or elevation, consists of many parts; since greatness of manner would disappear at once from the superficies, and the eye would compass something of what is little and mean.

Inigo Jones must not lose cast however because he introduces these breaks, and frequently. Popular taste at his time, coveted every thing that was Italian. The king, the court, and nobility, had already conceived these notions, which led them afterwards to vie with each other in the treasures of Italian decoration.

Inigo Jones in the Banquetting House, Whitehall, betrays something more than the ordinary sentiment of his school, by an introduction of these breaks in the façade. That licence so congenial to artist's feelings, seems there betrayed without violence to symmetry; and the effect generally entailed upon their adoption, seems lost in the happiness of his idea.

In the first place the front without them is sparing of details and of breaks. In the second place the building itself was one dedicated to mirth and pleasure: and ideas of strict utility or true support are waved, when the imagination is supposed to be affected by something of the sprightly joys and jovial spirit reigning within. The exterior reveals the interior; you care not as you gaze with your thoughts undisciplined upon the edifice of pleasure, whether you see the column relieving a depending weight, or supporting the various breaks of the entablature. The artist sought to please, and not to affect—to cheer, and not to impose.

With reference to the Persian court, in the design for the Whitehall Palace. There is a freedom, an ease, nay an almost negligent air, in the breaks and the figures that support them—and the object in view here, I conceive was, to please the eye of the king and his favourites. As if stiffness and solemnity were unwelcome to that monarch and his court:—as if the severities of rule, and the sternness of power, were to vanish at once in a building sacred to ease and kingly relaxation.

However much we may dislike their introduction as a custom in architecture—however much we may blame them viewed in the perspective of a street, and confusing to the eye in half profile, there seems something of agreeable pleasure in their aspect when displayed internally.

In his own dwelling, free from the struggles of life and the world, the statesman is half enchanted into playfulness, by the careless assemblage.—The accurate line, the finish of care the student displays, tending to renew thoughts of care and disquietude—vanish in the varied forms of the columns, which ministers to his ease, sooth and tranquilize, the brow of concern.

There is indeed a strange beauty in architecture. Like the composition of the poet and the painter, the design of the architect is at once a tale of interest—a delusive fiction or a startling truth—and the architect most insidiously works upon the gazer, who most studies the secrets of mental impression.

ON SUB-MARINE FOUNDATIONS.

Sir—There is in your last Journal a description of a light house lately erected under the auspices of Commander Denham, R.N., on a sand bank at the entrance of the Wyre Navigation. This structure has been supported upon and secured to the bank with Mitchell's patent screw moorings. The introduction of this principle to the mooring of vessels is good in the opinion of those who have tried them. They are durable, very compact, and take a firm hold of the ground by means of the flanges, which make them exceedingly applicable for that purpose; in rivers and in harbours they can be screwed down without much difficulty, through mud, sand, or shingle to a certain depth. They are, however, an expensive article, if we take into account the providing of barges and the labour of screwing them down, together with the patentee's charge for the mooring itself.

It would therefore have conferred a favour upon the profession if along with the description of the lighthouse we had been also informed of the cost of its erection. I am quite sure that it might have been done at far less expense on the old principle of driving piles into the ground.

The mooring screws are stated in the drawing to be 10 feet below low water mark, which I suppose may allow them to be 8 feet into the sand. Now the expense of a 3 feet mooring with the patentee's charge and the labour in fixing it to this depth would be about £50. On the other hand the cost of driving a pile, say 12 feet into the ground, with the additional length of timber, would not cost one-tenth of the sum, and piles can be driven into as firm a foundation as the screws. Where then is the great advantage of the screw mooring so applied but to increase the expense.

Again, in my opinion the framing ought to have been quite naked from half tide upwards, to prevent as much as possible the shock of heavy seas from injuring the structure, therefore, much dislike "the systematic interlacing of tension rods to render the fabric sufficiently opaque below the platform." I am also much mistaken if this system of bracing will not cause the tide to scour away the sand from the feet of the framing, and expose the screws to its action.

No practical engineer would in my opinion have adopted such a design.

I am Sir, your obedient servant,
One of the Old School.

TIDES OF THE OCEAN.

Sir—The Newtonian theory of the tides having been questioned by many, in which, I confess, I participate, I should esteem it a great favour, if some of your intelligent correspondents would weed my mind of the doubts that have taken deep root on this subject.

If the moon be the influential cause of the rise and the fall of the tides, why is her influence not universal?

Why does she seem to exercise her influence so powerfully on one sea, less in another, and not at all in others, and why is her supposed power entirely subdued by the effects of particular winds on certain coasts?

Why does the tide, ebb and flood, commence at each turn of the tide to run at the bottom of the sea before the water moves on its surface?

What is the cause that, at an island in the South Pacific Ocean, the time of high water is always the same?

I am aware that the moon and the tides retrograde coextensively, but this does not prove a coincidence.

I am aware, too, that it is said, by way of establishing a theory, that the Baltic and Mediterranean seas are not of sufficient expance to admit of the moon's influence—although the seas are much more extensive than the English or Irish channels—but the real cause why there is no ebb and flow tides in those seas is, that the seas do not rise or fall at either of the points connecting them with the ocean; for the flow and fall of the tides, and the velocity with which the current passes out and in of a tidal harbour or arm of the sea, is governed by the velocity and rise of the tides at the entrances thereto, and therefore, without looking for any other cause, here is the real *cause*.

The great difference of flow in the same sea, has, hitherto, not been satisfactorily accounted for.

Thus, for example, the flow on the eastern shores of America opposite the Straits of Gibraltar, is 30 to 40 feet—*none* on the latter.

A flow on the Pentland Ferbs and along the north coast of Scotland, of 20 or 30 feet; on the coast of Norway opposite, and at the Cattegat, the entrance to the Baltic, no rise in the water.

In the Irish Channel, on the coasts of England and Wales, the flow of the tide is great; on the Irish coast opposite, a small rise of the tides.

In the English Channel, on the French coast the flow is great; on the English coast but comparatively small.

If an allowance is made for the particular formation of parts of the coast, and other local circumstances, they are not sufficient to establish the accuracy of the Newtonian hypothesis on the tides.

I remain, your's, &c.,
14*th June*, 1840. Nauticus.

WATER OF THE VISTULA.

Sir—In your Journal of last month there appears an account of the casualty in Prussia,—the water of the Vistula having been diverted from its former course, and forced for itself a passage into the Baltic Sea in a new direction, at some distance from its former disemboguing point, *i. e.* via the Old Fairwater. As the current had previously, from times immemorial, passed into the ocean at the latter point, with great sluicing and scouring velocity, produced an impassable bar, so will the water, which now runs out at the new point, produce the like effects, by forming a bar at its new disemboguing point.

The bar at the Old Fairwater having some years back blocked up its entrance, and prevented ships entering to go up to Dantzig to discharge and load their cargoes. A new lateral cut was made, and so formed a passage to sea via the New Fairwater; and at the connecting part of the New Cut with the Vistula, a gate was fixed to prevent the current passage running to sea through the New Fairwater, and although this work has been completed for many years, no bank or bar has been formed at the new entrance, so that the egress or sluicing water constantly in its egress action, has blocked up the old entrance, but as there is no water or current passing to sea by the new Fairwater, no bar accumulates.

The division of the current, before alluded to, cannot in any way affect the entrance to Dantzig by the New Fairwater, but if the current of the Vistula should continue its new course, and not again return to its old channel, a material alteration will soon be discovered in the bar or bank at the entrance of the Old Fairwater.

Nauticus.

ON OBLIQUE ARCHES.

(In Reply to Mr. Buck, C.E., &c. &c.)

Sir—In consequence of what has already appeared in your Journal, I trust to your candour to insert my answer. I consider, Sir, that the insertion of it is not only due to me, individually, but to all who are interested in practical attainments. The facts which I state in reply are plain, and whilst they expose undue pretension, they have the merit of being in themselves irrefutable.

I am, Sir, very truly your's,

Peter Nicholson.

My attention was accidentally called, about the first instant, to an article in the *Railway Magazine*, of the 25th of January, 1840, written by Mr. G. W. Buck, of Ardwich, Manchester, in reply to some remarks which appear in my Treatise on the Oblique Arch, respecting some inconsistencies in certain formulæ, &c., in his "Essay" on the same subject. Mr. Buck says in his reply,—"At page 8 of his preface, in speaking of the forms of his templets which are necessary for working the stones, Mr. Nicholson says—'they are not shown by any other author who has wrote upon the subject.' Now, if Mr. Nicholson will refer to the 3rd chapter of my "Essay," he will find that chapter to be exclusively devoted to an explanation of the method of making the templets and working the voussoirs; moreover the fifth plate contains eight diagrams exhibiting the forms of these templets." Now, Sir, I *have* examined the third chapter of Mr. Buck's "Essay," and I can find *no* method explaining the making of the curved edges of the templets, Nos. 1 and 2, plate 26, in my work, to which I refer when I say "they are not shown by any other author who has written upon the subject;" and I have also examined the fifth plate in his "Essay," which, Mr. Buck says, contains eight diagrams exhibiting the forms of these templets, and I have been equally disappointed, for I can find *no such templets exhibited.* Mr. Buck does not even show how the radius of curvature of these templets may be found; neither does he give a hint that they are necessary. The arch squares, Nos. 3 and 4, entirely depend upon the curved edges of No. 2, and No. 1. Now, Sir, that Mr. Buck should have made these assertions is, to me, a matter of the utmost surprise, seeing that he must have known, when he made them, that he was deliberately stating that which was incorrect. The only method which Mr. Buck gives for working the arch stones is a very complicated and a very clumsy one, the principle of which he has taken from the 55th page of my work on Stone Cutting, published 12 years ago, and which method is much more difficult, even for a person possessed of considerable mathematical knowledge, to work by, and at the same time much more liable to error, than the method which I give, and which, in order to guard against error, I have adapted to the understanding of the most ordinary mason. In fact, it requires very little more attention than a common square segmental or semicircular arch, and the rules, or squares by which the stones are wrought are exceedingly simple in their construction. On this point it may not be amiss to add that although every mason is naturally inclined to work the bed of a stone first, yet, the first conception which I had of forming the stones of an oblique arch was certainly the most rational: first to form the soffit, then one of the beds, and lastly the other bed. And I did this because it was easier to conceive how the spiral surface might be obtained from the cylindric, than the cylindric surface from the spiral surface. This method of working the arch stones was, I believe, adopted from the year 1828, when my book on Stone Cutting was published, and continued until the year 1836, when Mr. Fox published a small Tract, as an original work on Oblique Arches, supposing himself to be the inventor of all that was known upon that subject. He says:—"But I am not aware that any rule has been published that would enable the stones to be wrought at the quarry into the desired form." The templets which Mr. Fox uses are shown in my Treatise on Masonry and Stone Cutting, plate 17, where the two equal circular-edged rules, Z, Z, the straight edge Y, and the arch square γ are those which he employs. Mr. Fox, after some trials in working arch stones, preferred to form the bed to the spiral surface of each arch stone first; and he was certainly the first to apply the winding straight edges for working the spiral surface of the beds, and to show the angle of the twist.

Mr. Buck next goes on to reply to the inconsistency which I noticed in certain formulæ, in his "Essay," and in one part of his Letter he says:—"Here I take the opportunity of saying that, after making the discovery of the mutual convergence of the chords of the curves of the joints of the face of the arch, and after obtaining the formulæ applicable thereto, I long sought in vain for a *demonstration* of the generality of this property. On applying to my mathematical friends, both in London and in Cambridge, I was equally unsuccessful. Under these circumstances, being experimentally quite certain of the existence of this property, I assume it as a postulate in the "Essay," and the whole of the investigation contained in the 7th, a concluding chapter *(the only part of the work which I consider theoretical)* is based upon it. The publisher, Mr. Weale, well knows how anxious I was to have given a demonstration in the work, and that I was finally under the necessity of publishing it without, although no one appears to have noticed this deficiency." This, Sir, I consider to be a sufficient admission of the justness of my remarks, and one which renders it perfectly unnecessary for me to allude further to those remarks at this time. Mr. Buck also says: "It is not my wish or intention to be drawn into a review of Mr. Nicholson's book, but I think it right to make the following few remarks. In problem 9, referring to plates 28 and 29, he gives directions for radiating the joints of the face of the arch in two different ways. By his first method the joints are to be at right angles to a tangent to the elliptic curve; by the second method they will radiate to the point of convergence, which I have denominated the focus; this latter method is that given by me, and which Mr. Nicholson has here adopted. Now, if the voussoirs be worked in spiral beds, *according to his rules,* they must necessarily radiate in this way; and consequently they cannot be made to radiate as described in his first method, *unless the beds are worked in some other way, the directions for which he has not given.* This dilemma leads me to infer that Mr. Nicholson is not practically familiar with the subject on which he has written. I have confined myself to the points referred to by Mr. Nicholson's strictures, or I might have added more on the subject."

Now, Sir, I will reply to these "remarks" in their order, premising that I never have objected to any one reviewing my works *provided that they are competent to the task*, and provided also that they come to the performance of that task in a fair and manly spirit! Now, Sir, first, as to the radiation of the joints. The lines *b h*, *c i*, *d j*, &c., (plate 28 in my book) are not the joints, neither are they intended to be representations of the joint lines; they are merely to direct the construction of fig. 2, in the same plate, in order to find the angles made by lines approximating nearly to the joint lines of the face of the arch, and tangents to the bed lines, or the angles made by these approximating lines to the joints on the face of the arch and tangents to the bed lines at the points in which they meet the plane of the face of the arch; and, in speaking of these lines in my work, at page 16, I say that the method is a near approximation, and that its simplicity is ample compensation for its introduction. Plate 29 of my "Guide to Railway Masonry," was engraved at the same time as plate 20, and is the same in every respect, as regards the construction of the two developements. Plate 20, and its explanation in page 6, was published in Part 2, May 11, 1839, and is referred to at page 27, as being necessary in the construction of plate 29. From the difficulty of getting the proofs from the printer, the third part was divided into two half parts; the first of which was published in August, and the second in November, at Newcastle-upon-Tyne, Mr. Buck's work being published in July, and the 29th plate in my "Guide," showing the method of drawing the joints, and which Mr. Buck says I have "adopted" from his work, being published in August, there was not time for me to have "adopted" his plan, even if I had been driven to such a strait as to think of, or to stoop to, such a thing; and, moreover, I can prove by my engraver *that all the plates in my book were finished* FOUR MONTHS *before the letter-press could be got from the printer, and a very considerable period before the publication of Mr. Buck's "Essay."* The joints in the elevation of the arch, plate 29, are drawn by an entirely different method from that used by Mr. Buck, although it may, perhaps, amount to the same thing, and are found by making the developements of the intrados and extrados of the arch, and transferring the points made in each developement by the joints to its corresponding curve in the elevation. These points being joined form the chords of the curves which form the joints in the elevation. We all know, Sir, that "facts are stubborn things," and I leave Mr. Buck to reconcile these facts with his somewhat fugacious assumption that I have "adopted" *his* plan in *my* book.

I now proceed to the second part in which Mr. Buck says—"this dilemma leads me to infer that Mr. Nicholson is not practically familiar with the subject upon which he has written," &c., and upon this point I will refer Mr. Buck to the 10th page of the History of Oblique Arches, in my work, which will, I think, convince him, if he be capable of conviction, that I was perfectly aware, when I wrote my work, of the nature of the joints in the elevation of an oblique arch; in addition to this, I may say that I have seen *nine* oblique bridges on "the Newcastle and North Shields Railway," and *five* on "the Brandling Junction Railway," all executed in stone, on the principle laid down by me, making, upon the two Railways *fourteen* bridges within a distance of about *eight* miles from Newcastle, and built, as it were, under my own immediate inspection. To this I may add, that one oblique bridge was built on "the Hartlepool Railway" in 1834, precisely on my principle, and that I have had the satisfaction of seeing all the stones which were formed by my templets unite closely without requiring the slightest alteration. By this bridge on "the Hartlepool Railway," I clearly show that a bridge was executed from the principles laid down in my Treatise on Masonry and Stone Cutting BEFORE ANY OTHER WORK WAS PUBLISHED ON THE SUBJECT, and that the templets shown in my "Guide to Railway Masonry," plate 26, No. 1, No. 2, No. 3, and No. 4, are decidedly my own discovery or invention. The finding of the angle of the twist is due to Mr. Fox, and I have already said the discovery of the point of convergence in which the chords of the curve of the joints of the arch stones in the face of the arch meet each other is due to Mr. Buck; but I here tell him that although the finding of this point is very useful in drawing an elevation, it is not absolutely necessary in the construction of the oblique arch; and I again maintain that, from the want of proper definitions of the terms used by him, he has written very obscurely of the principles on which he professes to treat, even in describing the common-place things contained in chapter 3. As a farther proof of the correctness of my principles, I insert the following letter which was spontaneously addressed to me by Mr. Welch, C.E., and Bridge Surveyor for the County of Northumberland:—

"Elswick Villas, Newcastle, April 18, 1840.
"To PETER NICHOLSON, ESQ.

"Sir,—Having now seen my design of the Oblique Bridge over the River Tees, on the line of the Great North of England Railway, successfully carried into effect, I am enabled to speak with certainty upon the correctness of your published principles for the construction of Oblique Arches. My bridge consists of four arches, built at an angle of 50°, the chord of the right section of each arch is 45·96 feet, and that of the oblique section is 60 feet. I may also state that I consider your work on the oblique arch the most practically useful of any that I have seen; and as the structure which is near to Croft fully warrants the highest opinion of it, I beg, as a member of the profession, for which you have done much, to thank you for the great pains you have taken in working out so clearly the principle of the Oblique Arch.

"I am, Sir, your most obedient servant,
"HENRY WELCH, Civil Engineer."

I think, Sir, I may safely place this testimony of a *practical man*, against Mr. Buck's assertion that I was not familiar with the subject upon which I had written!

I will now notice one very distinguishing feature between Mr. Buck's work and mine, although based upon the same principles:—Mr. Buck's work is only intended for the use of those who may happen to have been trained in a proper course of mathematical study, and which, I believe, is not the case with a tithe of the young men for whose use, chiefly, Mr. B. has written his book. On the other hand, mine is intended as a purely practical work, and as such, I have shown in it, how every useful length, distance, or angle of an oblique arch may be found, principally by common arithmetic, from the doctrine of similar triangles.

Since the above was written, I have seen an article signed "W. H. B." in the "Civil Engineer and Architect's Journal" for May, 1840, purporting to be "a few remarks on the construction of oblique arches, and some recent works on that subject, but which is, in fact, a mere echo of Mr. Buck's letter, and an ill-natured review of my book, written by some tyro, who understands lamentably little of the subject upon which he professes to write. W. H. B. says, in speaking of my book, "there is a problem 'to find the curved bevels for cutting the quoin heads of an oblique arch,' the reader being unable to learn, from the heading of the problem, whether it relates to square or spiral joints, naturally proceeds to wade through it, with the hope that it may afford some means of ascertaining this fact, but here he soon becomes lost in a labyrinth." Now, sir, I assert that W. H. B must either have been very inattentive, or very stupid, not to have observed to what species of joints the problem referred, since every page in which I treat of the oblique arch has the words "*On the Oblique Arch with Spiral Joints*," placed in capitals over it. W. H. B. next says, "you are told to divide the arc ABC into as many equal parts as the ring-stones are in number, and through the points of division draw *bk*, *ci*, *dj*, &c., perpendicular to the curve ADE." Again, he says, "you are told to join *am*, *bm*, *cm*, &c., but where the point *m* is to be placed Mr. Nicholson has quite forgotten to say." Here I acknowledge an error in point of reference; where I say divide the arc ABC, it should have been divide the arc ADE, which every *impartial* reader would have seen was a mere error in the type, as I immediately mention the arc ADE again, and I have also omitted to say, "draw GM perpendicular to GL." To show W. H. B. how difficult it is to keep clear of errors in printing, I will point out, in the two last sentences which I have quoted from him, no fewer than five blunders—*bk* is an error, there is not a *k* in the page in my book to which he refers; it ought to have been *bh*. Neither is there an *m* in the page, which he has mentioned four times. W. H. B. should at all events transcribe correctly from a work which he professes to criticise so profoundly, or he will assuredly lead both himself and others into "a labyrinth!"

I now state again to Mr. Buck, that neither himself, nor any other writer upon the oblique arch, has shown the templets by which the arch-stones are wrought by my method, and that I am the inventor of all those templets; and I further distinctly tell him, that *had he not pirated his principles from my work on stone cutting, his "Essay," in all probability, would never have been in existence.* I will also tell him that, however fine the theory of the principles of any scientific work may be, those principles will be literally useless, if not *properly adapted to the capacity of the person who has to execute the work!* That I have always considered as the grand object to be attained, and I think I may say, without vanity, after having received testimonials both *publicly and privately*, that I have not been altogether unsuccessful. The draughtsman will find my work on the oblique arch to be as useful and as simple in the delineation of his plans as any work on the subject in existence.

Now, Sir, in conclusion, let me state to Mr. Buck, that this may be the last time that I may have an opportunity of addressing him; for I am now an old man, and, in the ordinary course of nature, may be considered as standing upon the brink of the grave, and am, therefore, unable to undertake the exertion of further controversy with him. What I have done for the working man will be a theme for posterity, when neither Mr. Buck nor myself will have the power of hearing it. I pray that this may not be deemed the boast of an old man—as such it is not intended—but I have thought it my duty to say so much in justice to my own character, with which Mr. Buck has taken such unwarrantable liberties. I could not have rested satisfied without giving vent to my feelings at the ingratitude which Mr. Buck has shown. But, Sir, I have now done with him, and

"PALMAM QUI MERUIT, FERAT!"

PETER NICHOLSON.

Newcastle-on-Tyne, *May* 23, 1840.

SIR—In my paper on Oblique Bridges in reply to B. H. B., which is published in your Journal for this month, I have inadvertently inserted a few words which are incorrect, and ought to be expunged. At the second line from the bottom of the first column of the 198th page, the following sentence commences:—"this triangle must be supposed to exist in the thickness of the arch, *and to be parallel to a tangent plane at the point sought*, and therefore," &c. The words in italics I ought not to have inserted, and I shall be obliged by your giving notice to this effect in your next number.

Your most obedient servant,
Manchester, *June* 8, 1840. GEO. W. BUCK.

Antiquarian Discoveries in France.—"A discovery has recently been made at Bougon, near Mothe-Saint-Heray, in the Two Sevres, of a tumulus, which promises to throw great light on the civilization of the ancient Celts. A gallery and vast grotto has been opened. It is formed of nine stones in erect positions, covered by a slab twenty-six feet three inches in length. The interior is completely filled with bones. The head of each skeleton touches the walls of the grotto, and by the sides of each vases of baked earth, containing provisions for the use of the deceased in the other world, the wahala or paradise promised to the brave. Nuts and acorns are found in these vases in perfect preservation. There have also been found two hatchets and two knives made of flint, several smaller sharp instruments, the use of which is not known, two collars, or necklaces, one of shells and the other of baked earth, several bears' tusks, the bones of a dog, and a plate, upon which there are fragments of a rude design. Four of these vases are perfect: two of them very much resemble flower-pots; a third has the form of a soup-tureen; and the fourth, though much the smallest, is the most curious, as it is the cup of a Druid. The tumulus is two hundred paces in circumference, and between eighteen and twenty feet high. Its formation may be placed at 2,000 years ago. The vases and utensils attest the infancy of the arts, and the nascent civilization of a barbarous people."—*Quotidienne.*

Ancient Monuments.—A discovery has been made in a cellar in Paris, at the corner of the Rue Mauconseil, in the Rue Saint-Denis, of nine figures in stone, the size of life, having the heads and garments coloured and gilt. They are the figures of saints and kings, and one of them wears a helmet. They apparently belong to the earliest times of the revival of art; and have, in all probability, been buried where they were found, to escape the ravages of some outbreak of Iconoclasm. It is probable that they belonged to the ancient church of the *Pelerins de Saint-Jacques*, which stood near the site of their discovery.

AN ESSAY ON THE CONSTRUCTION OF OBLIQUE ARCHES.*

By Edward Sang, M.S.A., Civil Engineer, Edinburgh.

(Abridged from the Edinburgh New Philosophical Journal for April.)

Scarcely any branch of civil engineering bears so closely on the advancement of civilization as the art of road-making. The immense sums that are annually expended on them evince the importance of our roads. Our object is not merely to find a path from one town to another, we must be transported in the most expeditious manner possible. Is there a declivity; thousands are spent to remove it: is a road suspected of being a few yards longer than is needed? a new line is immediately chalked out. One might almost imagine that a monomania had seized us, and that the tulip, the dog, the pigeon, and all the other fanciers had deserted their peculiar departments to concentrate their energies on this one grand matter of roads. The madness is a very reasonable one; for if there be a hill, multitudes daily climb and descend it: or if a road be circuitous, the quantity of unnecessary travelling might soon be sufficient to carry one comfortably round the globe.

While journeying, we are often annoyed by bridges. Sometimes, for cheapness, they have been erected far out of the line of road, and we enjoy, on one side of a river, the delightful prospect of doubling along the other. At other times, after skirting the banks as if on a journey to the source, we are all at once wheeled right across the water, and ere we are certain that our necks are yet safe, an equally sudden turn restores us to our original direction. And occasionally our vexation is crowned by an altercation between the drivers as to which of two vehicles is bound to back down the steep slope of some antiquated erection. That time has now gone by when a bridge of any kind was hailed with satisfaction; we have scarcely such a thing as a ford wherewith to contrast it, and having only bridges to compare with bridges, we have become somewhat nice in our taste. Many of the old high-backed bridges have been replaced by others with level road-ways; these again by bridges with road-ways inclined to suit the elevation of the opposite banks, and now another improvement is beginning to be called for, that of crossing the river obliquely, so as to make the bridge harmonize with the general line. This we may consider as the *ne plus ultra* in bridge building, for then the road-way over the bridge coincides both in plan and in section with the rest of the road, and therefore conducts us in the easiest manner possible from the one bank to the other. The skewed arch is inseparable from the railway, as by its introduction alone the engineer is able to free the line from awkward and injurious turnings.

Having been consulted concerning the construction of an oblique bridge of considerable magnitude, and never having met with any regular investigation into the theory of such structures, I was induced to undertake the analysis. The results of that analysis I proceed to lay before the Society of Arts, in the hope that, though I may be wrong in supposing them new, their publication may serve to disseminate correct notions on this intricate subject. It is a common idea that the oblique is weaker than the right arch, and that the twist of the stones causes a great waste of material. The truth is, that if both bridges be skilfully constructed, there is no difference in point of strength between them, while the twist on the arch-stone of the oblique bridge causes a most trifling loss of matter, and therefore our road trustees should never hesitate to adopt that which agrees best with the rest of the line. There is no limit to the obliquity, nor need even the several abutments run parallel with each other.

The general question of the construction of an arch resolves itself into two parts; the first relating to the connexion which ought to exist between the curvature of the vault and the weight piled on each portion of it, is absolutely identical in the two cases of right and oblique bridges, and is therefore left out in the present inquiry; the second, however, relating to the forms of the arch-stones, bears directly on the oblique arch, and will therefore engross almost our whole attention. The outline of the bridge and the form of the vault having been determined on, the problem becomes this: *To cover the surface of the centering with blocks of such sizes and forms as may insure the stability of the structure.* Now, if it be premised that the curved surface of the vault must never be vertical, the solution of the problem can always be attained.

It is clear, from the general form of a bridge, that the lines of pressure ought to run from one abutment to the other, and should be contained in vertical planes parallel to the walls of the parapet. Imagine, then, that the vault is intersected by a multitude of such planes, the lines of intersection will indicate the directions in which the pressures ought to be transmitted from block to block. Now the stability of a structure is obtained by making the surfaces at which the pressures are communicated perpendicular to the directions of those pressures, and therefore all that is required is to trace on the surface of the centering a line which may cross all the lines of pressure at right angles. In the case of the right arch, that line is a parallel to the abutment; but in the oblique arch it becomes bent in a peculiar manner.

At the crown of the cylindrical oblique arch, the joint-line is perpendicular to the parapet; of course, it begins to descend on the surface of the vault, and as it descends it gradually bends away from that direction to become more and more nearly parallel to the abutment. If the crown line be regarded as the absciss, and the line of pressure as the corresponding ordinate of the joint, the differential co-efficient of the line of pressure is in all cases proportional to the cosine of the inclination which its extremity has to the horizon. If there be, then, two closely contiguous joints, the portions of the lines of pressure intercepted between them will be proportional to the cosines of the obliquities, and hence it follows that the breadth (measured on a line of pressure) of the stones in a given course diminish in the ratio just mentioned. It is a well known principle, that the strain upon any arch stone is proportional to the secant of the same obliquity; and thus, if the depth of the stones be augmented to meet this increased strain, it would follow that each voussoir in any given course ought to exhibit the same extent of section by a plane parallel to the parapet. The arch stones, both for convenience of workmanship and for appearance, must be uniformly disposed from side to side; and hence throughout the whole structure they ought to be of uniform volume, with the exception of the half stones left at the end of each alternate course for the purpose of *breaking the joint*. The deepening of the arch-stones toward the spring of the arch is often, though very improperly, omitted ; in such case the above statement does not hold true.

Even althouga the arch-stones were all equally broad upon the centering, those nearer the abutments would appear narrower on the Ground Plan, the breadths of their projections being proportional to the cosines of their obliquity: hence the ground plan of an oblique arch must present a very rapid diminution of breadths toward the spring of the arch, the breadths of the projections being, indeed, proportional to the squares of the cosines of the obliquities.

The Side Elevation of a vault with uniform voussoirs would exhibit narrower intervals toward the crown, the breadths being proportional to the sines of the obliquities; hence the side elevation of a skewed arch must present narrow intervals both at the crown and at the abutment, and wider intervals upon the shoulders. The breadths are proportional to the products of the sines by the cosines of the obliquities; that is, to the sines of twice the obliquities; and thus the side elevations of those arch-stones which are inclined at 45° will be the broadest.

The End Elevation, or the projection of a joint upon the plane of the parapet, possesses the very singular property of being entirely independent of the angle of the skew, and of depending alone on the form of the longitudinal section of the vault. This curious fact can very readily be demonstrated. The projection of a right angle upon a plane parallel to one of its sides is always a right angle, and therefore the projection of the joint upon the plane of the parapet must cross the projection of every line of pressure upon the same plane perpendicularly. But the projections of all the lines of pressure are equal to, and placed side by side with, each other, and are so whatever may be the angle of the skew, so that the delineation of the end elevation of a joint, which requires only the tracing of a line that may cross all these at right angles, will be performed exactly in the same manner whether the bridge be more or less oblique. When the angle of obliquity diminishes to zero, that is, when the bridge becomes *right*, the end projections of the joints contract into mere points, which points are the commencements, so to speak, of the permanent curves above mentioned.

The end elevations of the *beds* of the voussoirs, or rather of the lines formed by the intersection of these beds with the planes containing the lines of pressure, are also normals to the lines of pressure, and must therefore be tangents to the end projections of the joints. From this it follows, that a short portion of a course, or a single arch-stone, is very nearly contained between two planes slightly inclined to each other; and that, therefore, the loss of material arising from the *twist of the stone* must always be insignificant. Those engineers who have experienced a loss on this account, have done so because their bridges were not properly designed. If the stones be obtained in *squared blocks* from the quarry, there will be a loss on the ends of the stones; but this, as every builder knows, can be avoided by proper management in the quarry. And thus, on the whole, the loss of material for the skewed bridge need not exceed to any extent worth naming that for the right one.

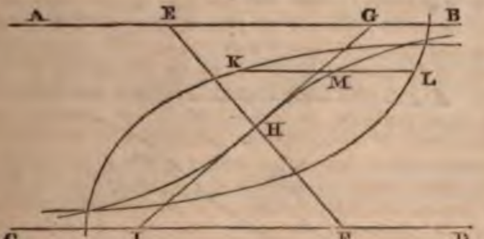
---

* Read before the Society for the Encouragement of the Useful Arts in Scotland, on 18th November and 2nd December, 1835; 27th January, 1836, and 16th May, 1838.

The above statements are true of cylindroid oblique arches, *whatever may be the forms of their principal sections*; they are at variance with the statements and so-called experience of engineers of established reputation: complete demonstrations of them are given in the appendix. They are equivalent to differential equations, and require to be integrated in order to give practical results; these results vary according to the particular form assumed for the longitudinal section of the vault. I proceed to give a few of these results, commencing, on account of its more frequent occurrence, with the circular arch.

On investigating the form of the projection of a joint of a circular oblique arch upon a horizontal plane, I arrived at a new curve, to which the name *Double Logarithmic* has been given.

Fig. 1.



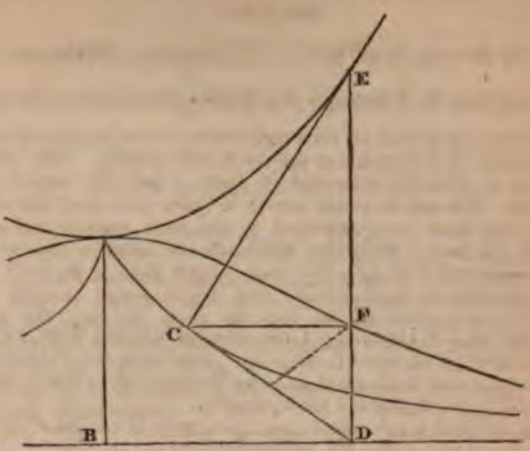
Having projected the entire semicylinder, of which only a portion can be used with propriety, let AB, CD, be the sides of the projection, and EF, parallel to the parapet, the plan of one of the lines of pressure. Bisect EF at right angles by GHI, and form two logarithmic curves of which AB, CD, may be the asymptotes, EG the common subtangent, their ordinates being parallel to EF. Then draw lines KL parallel to AB, and intercepted between the logarithmics, the middles M of these lines trace out the horizontal projection of one of the joints. The lines AB, CD, are thus asymptotes to the horizontal projection, and this geometrical property illustrates the mechanical impossibility of constructing a semicylindric arch, without trusting to the cohesion of the mortar. The introduction of the logarithmic curve into investigations concerning bridges, has been of great utility, and the analogy between this curve and the common catenary is striking. The catenary is also formed by bisecting the interval between two logarithmics; but these have a common asymptote with rectangular co-ordinates, while the bisected line is parallel to the ordinate. The computations needed for the delineation of such projections, are by no means tedious: they may be performed rapidly by help of Napierian logarithms; but a better method, capable of giving all the projections, will be explained shortly.

It may be expected, from what has been said of such elevations in general, that the end elevation of a circular oblique arch shall present some interesting peculiarity. The end elevation of a joint ought, in fact, to cross at right angles the circumferences of circles described with equal radius from points lying in a straight line; now, this is the distinguishing characteristic of the tractory, and that curve must therefore be exhibited on the end projections of all circular oblique arches.

On examining the projection of one of the joints upon a vertical plane perpendicular to the parapets, I obtained the genesis of a peculiar curve still logarithmic in its nature, and somewhat resembling in its form the superior branch of the conchoid. If we conceive the side elevation of the semicylinder to be traversed by horizontal lines, the distances intercepted on these lines bear to the corresponding distances intercepted by a certain normal curve, the ratio of cotangent of obliquity to radius. This normal curve, which belongs to an arch with its obliquity 45°, I have named the COMPANION TO THE TRACTORY; it admits of a very neat mechanical delineation.

Let a rod AB, equal in length to the radius of the arch, be made to rest upon a smooth board only at the point A, while the extremity B is guided along the line BD; A will, as is well known, describe the equitangential curve or tractory. Suppose that the guide to which the point B (or in an oblique position D), is attached, carries a vertical rule DFE, and that, on that rule, there slides a right angle DFC, one side of which is constrained to pass through C:* then will the point F trace the *Companion to the Tractory*. A very simple addition will convert this instrument into that described by Leslie in his Geometry of Curve Lines, for forming the catenary. A grooved rule has only to be attached, making the right angle DCE, while the groove DF is continued to meet it: E then traces out the catenary. Since, *from the nature of the figure*, $ED\ DF = AB^2$, it follows, that the companion to the tractory has its ordinates inversely proportional to those of the catenary, and that, therefore, it might, with propriety, have been named the *inverted catenary*.

Fig. 2.



All these projections of the joints, and the forms too of the individual arch-stones, can be much more readily obtained from the delineation of the surface of the centering. Regarding the crown line as the absciss, and the actual lines of pressure as the ordinates (on the curve surface), half the ordinate plus 45°, has its logarithmic tangent proportional to the absciss. Having once obtained the log-tangent corresponding to a given distance along the crown line, a simple proportion will give that corresponding to any other absciss; the log-tangent corresponding to half the length of an arch-stone having been found, the repeated addition of that quantity to itself will lead to a knowledge of the position of the corner of each stone in the whole structure, the simplest operations of trigonometry only being needed. Indeed, the labour of the whole calculation is but a minute fraction of that expended in the drawing of the plans. By these means, the accompanying model of the surface of the centering, its development, and various orthographic projections, were completed.* The simple inspection of these, and their comparison with most of the skewed bridges already constructed, will shew in what respects this branch of architecture has hitherto been defective.

I cannot leave the subject of the circular arch without indicating the extensive and indispensable use of logarithms in the calculations. Napier, when he founded first the rudiments of the fluxional calculus, and thence the logarithmic method, sanguine though he may have been as to the immense value of his discoveries, could never have imagined the prodigious impulse which they have since given to every branch of exact science. Each new mathematical research piles another stone on the monument of Napier.

Neither can I avoid remarking, that the ingenious speculations of the earlier geometers concerning the various mechanical curves, speculations which have been by many regarded as fanciful and useless, are one by one turning to account in the progress of modern philosophy.

The elliptic arch, being much recommended by the gracefulness of its form, is frequently used. If we view the circular oblique arch from a distant point in the continuation of its axis, it does indeed appear elliptical; but then the ellipse has its major axis directed vertically, so that a circular skewed bridge can hardly have a fine appearance unless the segment be extremely flat. Let us then inquire into the phases of an elliptic skew.

The horizontal plan of the joint is still a double logarithmic curve; and its delineation, including, of course, that for the circular arch, is as follows.

EF being as before, the plan of one of the lines of pressure, find HQ a third proportional to the horizontal and the vertical semi-axis; through Q draw Q'E parallel to HG. Describe then logarithmics having E'G for their common subtangent, and having their ordinates

---

* In practice, it would be more convenient to lay a jointed rod equal to half AB from the middle of AB to the rule DFE as indicated by the dotted lines.

* These are deposited in the Museum of the Society of Arts of Scotland

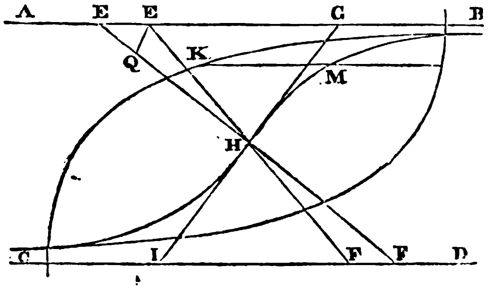
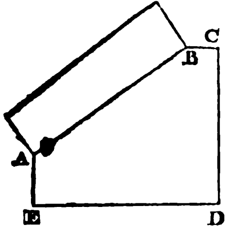


Fig. 3.

parallel to E'H, the bisection of the interval between these will give the horizontal projection of the joint. Similarly, the side and end projections are modifications of those belonging to the circular arch:—they are fully investigated in the appendix.

Having obtained a tolerable approximation to the forms of the arch stones, it is not uncommon for bridge-builders to throw the remaining responsibility on the abutments, which, besides transmitting the pressure, have to continue its distribution among the parts of the pier. In truth, the principles of equilibrium seem never, even in the case of the right arch, to have penetrated beyond the facing stones of the piers; and the effect of the arrangement *in every bridge which I have seen, or the drawings for which I have inspected*, is to throw the whole weight of the arch on the outside stones of the pier and on the outer row of piles in the foundation. To see this clearly, let us draw one of the abutment stones of a right bridge. The oblique face AB receives the pressure of the lowest voussoir; and it ought to receive that pressure perpendicularly. But the stone is prevented from yielding by resistances against the surfaces CD, DE: the pressure of the voussoir is thus decomposed into two pressures, one against CD, well known to be the horizontal thrust of the bridge, and the other against DE, equal to the weight of all the mason-work between the crown of the arch and the vertical line through B. Now, since all the stones of the piers are squared, no change (except by improper straining) can take place in the directions in which these pressures are propagated. The pressure against CD is communicated along the abutment course to the spring of the next arch, or to the corresponding breadth of the final abutment; while the pressure against CD is transmitted through the facing stones of the pier to the outer row of piles. It will, indeed, be said, that the cohesion of the mortar, and the alternate jointing of the courses. render the pier one mass, and that, therefore, such niceties are not worthy of attention. But, indeed! is the final disposal of the entire strain of a bridge such a trifle? Then let us fit our arch-stones by guess, and sweep the span in any fancy. It is at this very corner that all the care of the engineer is required; and I do maintain, that the method in common use outrages the doctrines of equilibrium, and renders our arches less secure than they ought to be. It is a piece of bad engineering to throw the whole weight of a bridge upon one row of its supports, and to give the others scarcely any strain; especially when it is considered that that row is most liable to decay. The alternate jointing of the stones calls into action that species of resistance which ordinary building-material is least capable of exhibiting; one end of a stone is pressed downwards, while its other end is engaged between two blocks; the consequence is a tendency to break the stone over, to *distend* its upper surface; and it is notorious that the strength of stones in this way is much inferior to their power of resisting a simple crush. The alternate jointing and the mortar are useful enough in correcting the bad effects of unavoidable inaccuracy; there is no need for deliberate error to put them to a severer use.



The best possible arrangement is to give to each square foot of the foundation its fair share of the whole burden. In order to do this, it becomes necessary to lay a counter arch, of a parabolic form (its convexity downwards), upon the pier-head. Such an abutment course would carry the horizontal thrust to the spring of the next arch, precisely as a flat course would; but it would distribute a uniform downward pressure on each horizontal foot; and, in this way, the foundation would be pressed on exactly as if the whole weight of masonwork, from the crown of the one arch to the crown of the other, were piled upon it in squared courses.

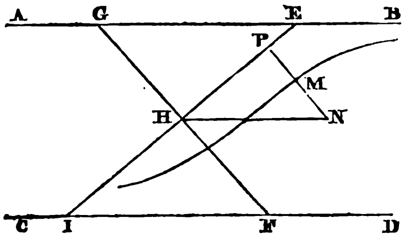
On investigating the forms of the joint on a parabolic skew, I found its plan to be a line of the third order, the double parabola; that its end elevation is a semi-cubic parabola; and that its side eleva
another line of the same order. Students of the higher mathe
will at once recognise the equations of these curves as the res
other inquiries. For the computations of the parts, on account
regular progression of the different examples, the method exp
in my treatise *On the Solution of Equations of All Orders*, v
found to afford peculiar facilities.

Appendix.

In the preceding part of this paper, I have stated the genera
ciples which ought to regulate the construction of oblique arche
this, the second part, I propose to enter more into detail, and t
the demonstrations of the theorems above laid down.

The general investigation into the stability of a vault would
sarily be complicated by the peculiarities of the ultimate abut
and by the assumed directions of the lines of pressure; for the
rections are, within certain limits, arbitrary. For the present
pose, it is enough to consider the case of a vault resting on p
abutments, cylindroid, and having the lines of pressure contain
vertical planes parallel to each other.

Fig. 5.



Let AB, CD, represent the two abutments, HN the crown line
and PN the horizontal projections of two of the lines of pressure.

Of rectangular co-ordinates, let the x be in the direction HG,
in PM, and the z vertically. For convenience, also assume ot
co-ordinates v along HN, u along NM, and z as before; put also
the angle of the skew $= s$. The formulæ of conversion will be

$$\left.\begin{array}{l} x = v\cos s,\ \ y = v\sin s - u;\ \ z = z \\ v = x\sec s,\ \ u = x\tan s - y,\ \ z = z \end{array}\right\} \quad . \ . \ \text{A}$$

If the equation of the generating curve of the vault, of which
the projection, be taken

$$u - \phi z = 0 = \text{B}$$

the same equation will serve as that of the vault itself; or in re
gular co-ordinates

$$x\tan s - y - \phi z = 0 = \text{B, whence}$$

$$\frac{d\text{B}}{dx} = \tan s;\ \frac{d\text{B}}{dy} = -1;\ \frac{d\text{B}}{dz} = \phi' z.$$

The equation of the plane containing one of the lines of pressu

$$x - \text{X} = 0 = c;\ \text{whence}$$

$$\frac{dc}{dx} = 1, \frac{dc}{dy} = 0;\ \frac{dc}{dz} = 0;$$

so that the equations of the straight line touching B =, 0 $c = 0$

$$\frac{\text{X} - x}{0} = \frac{\text{Y} - y}{-\phi' z} = \frac{\text{Z} - z}{-1} \quad . \ . \ \text{(D)}$$

where X, Y, Z belong to any point in the tangent; x, y, z to the
of contact.

Again, let $u - \theta v = 0 = \text{E}$ be the equation of the horizontal
jection of a joint, or in rectangular co-ordinates,

$$x\tan s - y - \theta\,(x\sec s) = 0 = \text{E};\ \text{then}$$

$$\frac{d\text{E}}{dx} = \tan s - \sec s.\,\theta' v;\ \frac{d\text{E}}{dy} = -1;\ \frac{d\text{E}}{dz} = 0.$$

The equations of the joint are $\text{B} = 0$, $c = 0$, therefore, those
line tangent to it are

$$\frac{\text{X} - x}{\phi' z} = \frac{\text{Y} - y}{\phi' z\,(\tan s - \sec s.\,\theta' v)} = \frac{\text{Z} - z}{\sec s.\,\theta' v} \quad . \ . \ \text{(F)}$$

The stability of the structure demands, that the line whose equat
are (F) be perpendicular to that whose equations are (D), there
the condition of stability is contained in this equation,

$$(\phi' z)^2\,(\sin s - \theta' v) = \theta' v$$

$$\left.\begin{array}{ll}\text{or} & \phi' z = \sqrt{\left\{\dfrac{\theta' v}{\sin s - \theta' v}\right\}} \\ \text{or} & \theta' v = \sin s \dfrac{(\phi' z)^2}{1+(\phi' z)^2}\end{array}\right\} \quad . \; . \; . \; (G)$$

The last formula may also be put thus:

$$\frac{\delta u}{\delta v} = \sin s \frac{d u^2}{d u^2 + d z^2}$$

in which the characteristic δ refers to the joint, d to the line of pressure. But $\frac{d u^2}{d u^2 + d z^2}$ is the square of the cosine of the inclination of the line of pressure to the horizon; whence, if we denote that inclination by i,

$$\frac{\delta u}{\delta v} = \sin s . \cos i^2 \quad . \; . \; . \; (H)$$

When, then, as is the case at the crown of the arch, i is zero $\frac{\delta u}{\delta v} = \sin s$; but $\frac{\delta u}{\delta v} = -\frac{\delta y}{\delta v} + \sin s$ so that, at the crown, $\frac{\delta y}{\delta v} = o$, that is, the horizontal projection of the joint, is there perpendicular to the parapet, as might easily have been anticipated; but when i increases, its cosine decreases, and therefore $\frac{\delta y}{\delta v} = \sin s . \sin i^2$ (I) must increase: that is, the line must bend away, from being perpendicular to the parapet, until, if i could reach 90°, it would be parallel to the abutment.

Since $\frac{\delta v}{\delta x} = \sec s$, the above quotation put in rectangular co-ordinates ecomes,

$$\frac{\delta y}{\delta x} = \tan s . \sin i^2 \quad . \; . \; . \; (K)$$

If a be taken to represent the arc of which u is the projection, $\cos i = \frac{du}{da}$ and equation H becomes,

$$\frac{\delta a}{\delta v} = \sin s . \cos i \quad . \; . \; . \; (L)$$

ad thus, if we imagine two joints running quite close to each other, atting the crown-line at the minute distance δv, the distance δa, inercepted between them on the arc, or the breadth of the course, is roportional to cosine i.

The above equation can also be put under the form

$$\frac{\delta a}{\delta x} = \tan s . \cos i \quad . \; . \; . \; (M)$$

Again, we have $\frac{\delta u}{\delta z} = \cot i$; whence equation H becomes,

$$\frac{\delta z}{\delta v} = \sin s . \sin i . \cos i = \tfrac{1}{2} \sin s . \sin 2 i . \quad . \; . \; . \; (N)$$

$$\frac{\delta z}{\delta x} = \tan s . \sin i . \cos i = \tfrac{1}{2} \tan s . \sin 2 i . \quad . \; . \; . \; (O)$$

From which it will be seen, that the general statement made as to he side elevation of the joint is true.

Lastly, we have

$$\frac{\delta y}{\delta z} = \sin s \frac{\delta v}{\delta z} - \frac{\delta u}{\delta z} = \tan i = \frac{\delta z}{\delta u} \quad . \; . \; . \; (P)$$

hence it is, that the end elevation of the joint crosses that of the line pressure at right angles.

Before proceeding to apply the above differential equations to parular cases, the following recapitulation may be made:

Equation H gives the Horizontal Projection.
.. L .. Development.
.. O .. Side Elevation.
.. P .. End Elevation of the Joint.

And it is to be remarked, that these equations are absolutely general, plying to every skewed cylindroid arch.

Having now completed the general investigation, I proceed to apply e principles to specific cases; in the first case to the circular arch.

Denoting by r the radius of the circle, we have

$$i = \frac{a}{r},\; z = r \cos \frac{a}{r},\; u = r \sin \frac{a}{r};\; z^2 + u^2 = r^2;$$

uations which take the place of (B) in the general analysis.

For the horizontal projection of a joint we have

$$\frac{\delta u}{\delta v} = \sin s \left(\cos \frac{a}{r}\right)^2 = \sin s \frac{r^2 - u^2}{r^2}$$

and thus

$$\frac{\delta v}{\delta u} = \text{cse } s . \frac{r^2}{r^2 - u^2};$$

whence integrating

$$v = r . \text{ cse } s \text{ nep. log} \sqrt{\left(\frac{r+u}{r+u}\right)}$$

Now $v' = r .$ cse $s .$ nep. log $(r + u)$ is the equation of a logarithmic curve to oblique co-ordinates having one side of the semicylinder for its axis, and r cse $s .$ for its subtangent: while $- v'' = r .$ cse $s .$ nep. log $(r - u)$ is that of a similar curve having the other side of the semi-cylinder for its asymptote, and thus the v of the joint which is the arithmetical mean of these is obtained by bisecting the interval between the two logarithmics.

Passing to common logarithms, and putting M for the modulus, ·43429448, &c. we have

$$v = \frac{r . \text{ cse } s}{2 \text{ M}} \log \frac{r+u}{r-u}$$

$$u = r \frac{10^{\frac{2 \text{ M } v}{r \text{ cse } s}} - 1}{10^{\frac{2 \text{ M } v}{r \text{ cse } s}} + 1}.$$

The horizontal projection of the joint of a circular skewed arch is thus a new curve, to which I have given the name of Double Logarithmic: the analogy between this curve and the common catenary has already been pointed out.

In order to trace the side elevation, we must resume equation (O) which, when adapted to the circular arch, is

$$\frac{\delta z}{\delta x} = \tan s . \frac{z}{r} \sqrt{\left(\frac{r^2 - z^2}{r^2}\right)} \qquad \text{whence}$$

$$k = \frac{r . \cot s}{z} \text{ nep. log} \frac{r + \sqrt{r^2 - s^2}}{r - \sqrt{r^2 - z^2}}$$

$$= \text{nep log } 10 . \; r . \cot s \log \tan \left(45° + \frac{a}{2 r}\right)$$

But the equation

$$x' = \frac{r}{z} \text{ nep. log} \frac{r + \sqrt{r^2 - z^2}}{r - \sqrt{r^2 - z}} - \sqrt{r^2 - z^2}$$

is just the equation of the tractory, whence

$$x'' = \frac{r}{z} \text{ nep. log} \frac{r + \sqrt{r^2 - z^2}}{r - \sqrt{r^2 - z^2}}$$

is the equation of a curve having its ordinates greater than those of the tractory by the quantity $\sqrt{r^2 - z^2}$, this curve I have named the *companion to the tractory*, or, on account of the connection which is explained in the paper, and which at once flows from the above, the *inverted catenary*.

The equation for the end elevation of a joint adapted to the circular arch is

$$\frac{\delta y}{\delta z} = \sqrt{\left(\frac{r^2 - z^2}{r^2}\right)} \qquad \text{whence}$$

$$-y = \text{nep. log} \sqrt{\left\{\frac{r + \sqrt{r^2 - z^2}}{r - \sqrt{r^2 - z^2}}\right\}} - \sqrt{r^2 - z^2}$$

which is the well known equation of the tractory. This is the characteristic curve of the circular oblique arch: as all tractories are similar to each other, it is easy to make a table of its co-ordinates.

The preceding equations enable us to obtain any one of the projections of the joint, and are essential to a knowledge of the nature of the different curves. They are, however, inconvenient when we wish to ascertain the dimensions of the individual arch-stones, and need, for that purpose, to know the intersection of the joint with any one of the lines of pressure. The equation of the development furnishes us with the means of obtaining these points, as well as all the projections, by processes remarkable for their simplicity. To find this equation I resume (L) which, adapted to the circular arch, becomes

$$\frac{\delta v}{\delta a} = \text{cse } s. \sec \frac{a}{r} \qquad \text{whence}$$

$$v = r. \text{ cse } s. \text{ nep. log tan} \left(\frac{\pi}{4} + \frac{a}{2r}\right)$$

or, observing that $\frac{a}{r} = i$, and passing to common logarithmic tables,

$$v = \text{nep. log } 10.\, r \text{ cse } s. \text{ log tan } (45^\circ + \frac{i}{2})$$

whence by inversion

$$\text{log tan } (45^\circ + \frac{i}{2}) = \frac{\text{M. sin } s}{r}.\, v.$$

from which the values of i can be very easily found; especially when they correspond to equi-different values of r.

The expert computer will now perceive at a glance, that all the operations needed to determine the co-ordinates of the various points may now be arranged in a simple tabular form so as to require scarcely any figuring.

I now proceed to the Elliptic Oblique Arch. Put r for the horizontal and ρ for the vertical radius; the equation of the curve then becomes

$$\frac{u^2}{r^2} + \frac{z^2}{\rho^2} = 1$$

which takes the place of (B).

This equation may also be put under the form

$$u = r \sin \alpha, z = \rho \cos \alpha.$$

where α is the inclination of the trammel bar that would trace out the ellipse; from this we find

$$\frac{\delta v}{\delta \alpha} = \frac{\text{cse } s}{r} \left\{ (r^2 - \rho^2) \cos \alpha + \rho^2 \sec \alpha \right\} \qquad \text{whence}$$

$$v = \frac{\text{cse } s}{r} \left\{ (r^2 - \rho^2) \sin \alpha + \rho^2 \text{ nep log tan} \left(45 + \frac{\alpha}{2}\right) \right\}$$

Otherwise we obtain

$$\frac{\delta v}{\delta u} = \frac{\text{cse } s}{r} \left\{ (r^2 - \rho^2) + \rho^2 \frac{r}{r^2 - u^2} \right\}$$

$$v = \text{cse } s \left\{ \frac{r^2 - \rho^2}{r^3} u + \frac{\rho^2}{r} \text{ nep log} \sqrt{\left(\frac{r+u}{r-u}\right)} \right\}$$

At first glance it might be thought that this equation gives a new curve; it is, however, still a double logarithmic, having its parts determined in the manner already described.

To find the side elevation we have

$$\frac{\delta z}{\delta r} = \tan s \frac{- r \rho z \sqrt{\rho^2 - z^2}}{\rho^4 + (r^2 - \rho^2) z^2} \qquad \text{whence}$$

$$x = \cot s \left\{ \frac{r^2 - \rho^2}{r \rho} \sqrt{\rho^2 - z^2} + \frac{\rho^2}{r} \log \sqrt{\left(\frac{\rho + \sqrt{\rho^2 - z^2}}{\rho - \sqrt{\rho^2 - z^2}}\right)} \right\};$$

it is, however, more easily determined thus

$$\frac{\delta x}{\delta z} = \cot s \frac{r^2 + \rho^2 \tan \alpha}{r \rho \tan \alpha}$$

$$= \cot s \left\{ \frac{r}{\rho} \cot \alpha + \frac{\rho}{r} \tan \alpha \right\}$$

$$\text{But } \delta z = - \rho \sin \alpha.\, \delta \alpha. \qquad \text{whence}$$

$$x = - \cot s \left\{ \frac{r^2 - \rho^2}{r} \sin \alpha + \frac{\rho^2}{r} \text{ nep. l. tan} \left(45 + \frac{\alpha}{2}\right) \right\}$$

For the end elevation we have recourse to equation (P) which gives

$$\frac{\delta y}{\delta \alpha} = \frac{\rho^2}{r} \left\{ \sec \alpha - \cos \alpha \right\} \qquad \text{and thus}$$

$$y = \frac{\rho^2}{r} \left\{ \text{nep. log tan } (45 + \tfrac{1}{2} \alpha) - \sin \alpha \right\}$$

which is the equation of the tractory modified by the existence of the factor $\frac{\rho}{r}$. From this equation the determination of the individual point is most easily obtained.

I now proceed to consider the Parabolic Arch. f being the focal distance, the equation of the parabola is

$$u^2 = 4 f z, \text{ whence } u\, d u = 2 f\, d z$$

whence again the equation

$$v = \text{cse } s \left\{ u + \frac{u^3}{12 f^2} \right\}$$

which belongs to the horizontal projection; also

$$x = \cot s \left\{ 2 u + \frac{u^3}{6 f^2} \right\} \qquad \text{or}$$

$$x = \cot s. \frac{2}{3} \sqrt{f z} \left\{ 3 + \frac{z}{f} \right\}:$$

and also

$$y^2 = \frac{4 z^3}{9 f}$$

which are the equations of the three projections.

I have now run over the equations which serve to determine the different parts of oblique, circular, elliptic, and parabolic arches, and had intended to supply examples of the requisite calculations; but after proceeding to some length in this, it occurred to me that those who have followed the preceding investigations stand in no need of such illustrations, and that these, therefore, would merely occupy room without being productive of any benefit.

HARBOURS (SOUTH EASTERN COAST.)

A Copy of the Report of the Commissioners appointed to Survey the Harbours of the South-Eastern Coast, to the Lords Commissioners of the Admiralty.

WITH AN ENGRAVING, PLATE XII.

Having completed the inquiry on the subject of the Harbours on the South-Eastern coast of England, we request you will lay before the Lords Commissioners of the Admiralty the result of our investigation.

Mr. Wood's letter of the 25th of July last conveyed to us the directions of their Lordships "to visit the coast between the mouth of the Thames and Selsea Bill, and to examine and report on the state of the existing harbours between those points, with reference to their being available as places of shelter for vessels passing through the channel, in case of distress from weather, and also as places of refuge for merchant vessels from enemy's cruizers in time of war, and more especially as to their being made stations for armed steam-vessels employed for the protection of our trade in the narrow part of the channel;" for which purpose, the harbours being accessible at all times of tide, and their capability of defence, were stated to be most important considerations.

Their Lordships further desired us "to report as to what situations we would recommend as best calculated for these various purposes; whether in any of the existing harbours, or at any other places within the assigned limits; and also what works would be necessary to render them available; and what the probable expense of the undertaking would be."

Before entering into the details of the subject, it will be proper to state that a question arose whether it fell within the province of the Committee to offer any remarks on those harbours which were found on inspection to be incapable of access at all times of tide.

A perfect harbour of refuge, we understand to mean, such as is capable of receiving any class of vessels, under all circumstances of wind and tide.

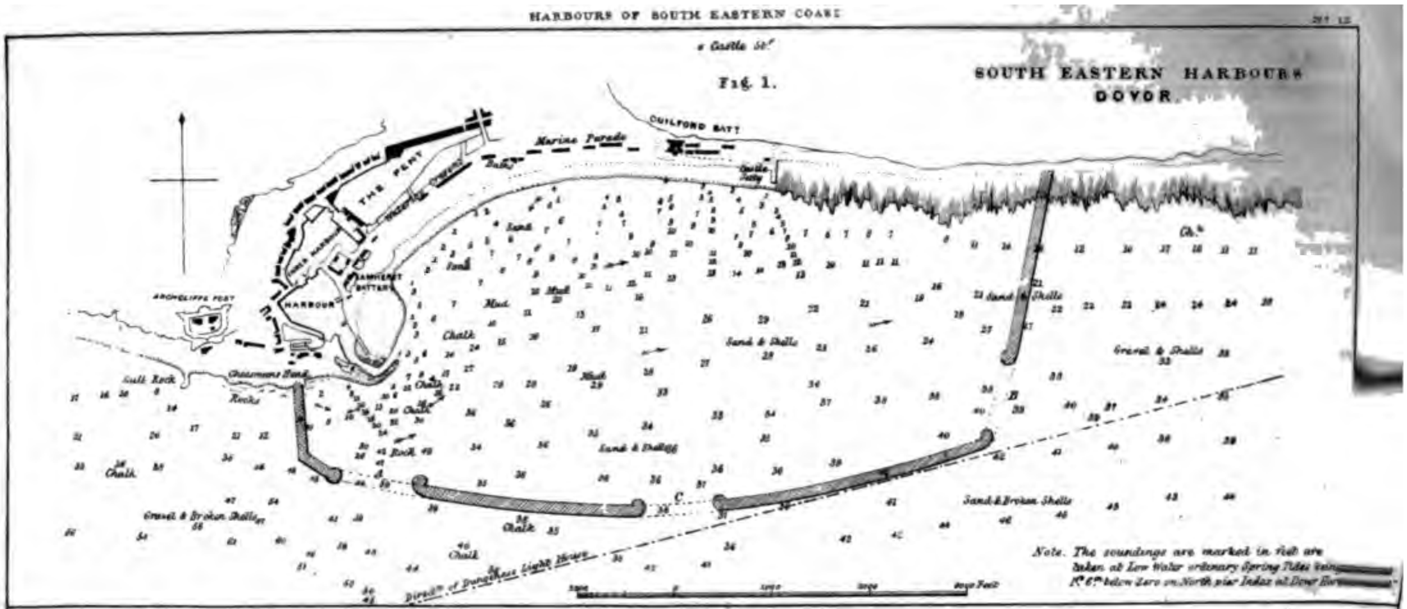
Now there is no such harbour along the whole range of coast from the Nore to Selsea Bill; nor are any of the existing harbours capable, by any improvements or alterations to their present entrances, of being made accessible at low water even to the extent of six feet, with floating berthage inside.

Most of the harbours on this part of the coast are formed by piers carried out from the main land, and are tidal harbours, dry or nearly so at low water, with bars at their entrances: these harbours would therefore be excluded from our consideration, if their capability of being made available at all times of tide was to be considered a necessary condition.

There can be no doubt, however, that the existing harbours are of importance to merchant vessels of the smaller classes at various times of tide, according to their draught of water; and though they may not be capable of receiving a large ship, may afford shelter to a smaller one; and thereby become a harbour of refuge to a class of vessels the most numerous and least prepared for heavy weather, or to escape an enemy in time of war.

The value of such imperfect harbours is also increased by the diminution of late years in the size of trading vessels. The large class of ships which were employed in the West India, and the still larger in the East India trades, have been succeeded by vessels of much smaller tonnage. The coasting and coal trades are carried on in vessels of comparatively light draught of water; and steam-vessels, whose draught is easy compared with sailing-vessels of equal tonnage, are rapidly increasing in number, and often supply the places of the larger class of vessels which were formerly employed in the merchant service.

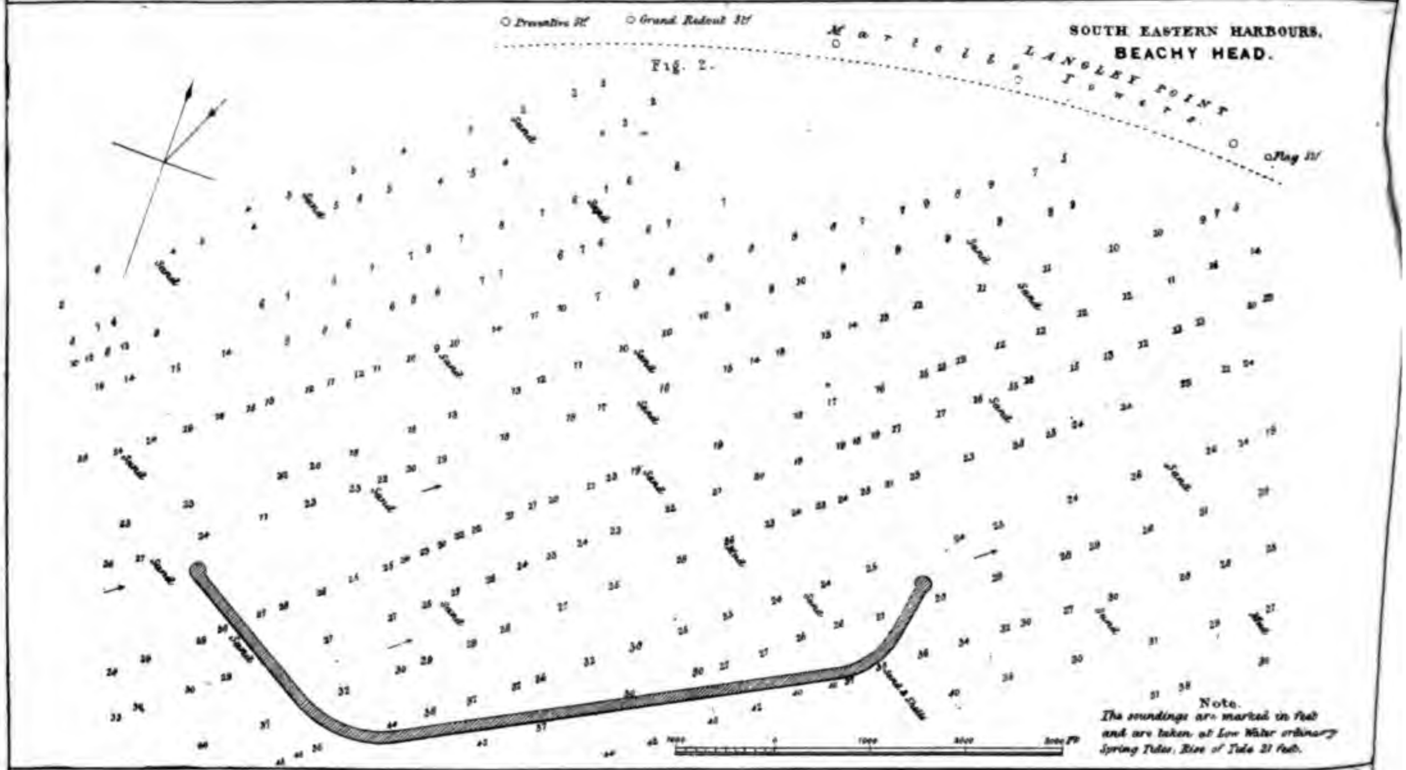
Fig. 1.



SOUTH EASTERN HARBOURS
DOVOR.

Note. The soundings are marked in feet are taken at Low Water ordinary Spring Tides being Fᵗ 6ⁱⁿ below Zero on North pier Index at Dover Har

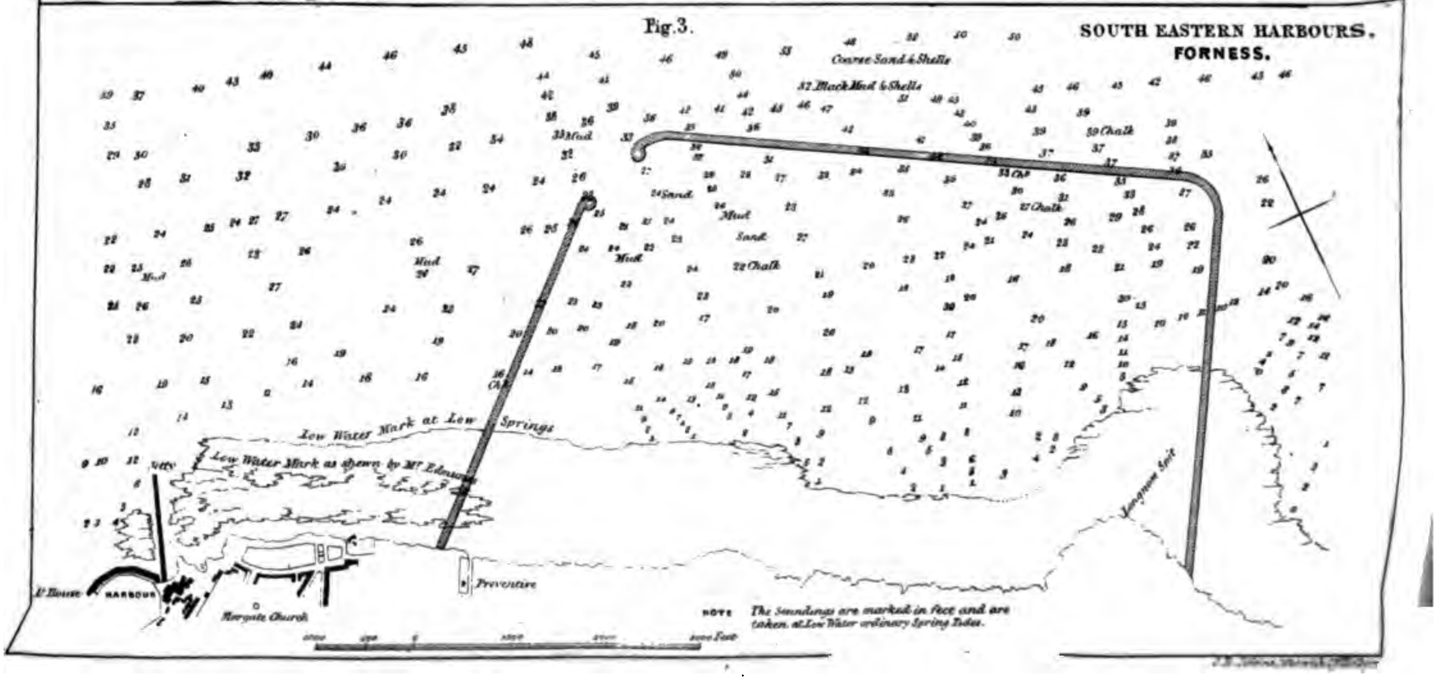
Fig. 2.



SOUTH EASTERN HARBOURS,
BEACHY HEAD.

Note.
The soundings are marked in feet and are taken at Low Water ordinary Spring Tides, Rise of Tide 21 feet.

Fig. 3.



SOUTH EASTERN HARBOURS.
FORNESS.

NOTE *The Soundings are marked in feet and are taken at Low Water ordinary Spring Tides.*

To these vessels, therefore, some of the harbours at the present moment are open for several hours of each tide, and a few of them may be capable of being rendered more accessible by the removal of obstructions at their entrances, or by additional works.

This part of the coast possesses the advantage of a good rise of tide; and though the harbours are only available under special conditions, the numerous instances of shelter and protection afforded by each to ships in distress, serve to show their value in a national point of view, and the importance of not allowing them to fall to decay.

Although, therefore, we are convinced that none of them can be made perfect harbours of refuge, we still have considered them as falling within the scope of our inquiry; not as requiring from us specific details of the works which may be deemed desirable, but to explain briefly their present extent and capabilities, and to note generally what may have presented itself to us in the way of improvement; and we therefore propose to consider the objects of the inquiry under two heads, viz.: 1st, The state and capabilities of the existing harbours, &c., (in the order in which we visited them); and 2ndly, The situations best calculated for harbours of refuge, and as stations for armed steam-vessels in the event of war; confining to harbours for these latter objects, the necessary condition of being accessible at all times of tide.

The river Thames is usually considered to terminate at the Nore. From the Isle of Sheppey to Westgate Bay, the numerous sands and shoals which extend in all directions along the coast, prevent the approach of vessels of any size; and the cliffs, which consist of sand and clay, are gradually yielding to the action of the sea, and supply a constant source of materials for fresh accumulations.

We did not, therefore, consider it necessary to visit this part of the coast, where no harbours at present exist.

Margate.

Margate was the first place at which we landed after leaving the river.

The harbour is situated in a small bay between two extensive flats of chalk rocks, the Nayland on the west, and the Fulsam on the east, both of which are covered before high water. The artificial harbour is formed by a stone pier, which commences on the eastern side of the bay (around which the town is situated), and extends 800 feet to the westward, in an irregular curve, leaving the entrance open to the north-west.

The rise of average spring tides at the pier-head, is about 13 feet, and that of neap tides eight feet; but spring tides ebb outside of the pier-head, and leave the harbour dry at low water. A wooden jetty has been run out from the root of the pier, over the Fulsam rocks, to the distance of 1,100 feet, for the convenience of passengers, &c., landing from or embarking in the steam-packets at low water.

The pier and jetty belong to a joint-stock company, the chairman, surveyor, and harbour-master of which attended us, and gave us the information we required.

It is evident that the harbour in its present state possesses none of the requisites of a harbour of refuge, and can only be considered valuable, in a national point of view, as affording the means of supplying pilots, anchors, and cables, &c., to vessels driven into the roads in distress.

The surveyor, by order of the directors of the pier and harbour company, prepared and submitted to us a design for constructing a harbour of refuge at this place, by extending curved piers upon the Nayland and Fulsam rocks; enclosing an area of considerable extent on and around the site of the present harbour, and leaving an entrance of 300 or 400 feet in width towards the north-east, with 16 feet depth of water at the mouth.

The expense of such a work is estimated by the surveyor at 275,000*l.*; but the cost of deepening the harbour is not included in this sum; and as the bottom rises gradually to the beach, the area possessing even 8 feet water would be very limited, and considerable excavations would be necessary to render it available to any extent.

A second design was submitted to us, said to be formed on a plan suggested by the late Mr. Rennie, who is quoted as having thought highly of the situation for a harbour of refuge. It consisted of an outer harbour of less dimensions than the one proposed by the directors of the pier and harbour company, enclosed by walls; and an inner basin with gates to shut in the water at flood-tide, for the purpose of clearing the entrance at low water.

The power of sluicing at so great a distance as that proposed in this plan, could only be applied with advantage to a surface dry, or nearly so, at low water; and the idea of keeping a deep-water harbour of any useful width, clear by means of such sluicing, appears to us to be impracticable.

Several other plans were brought before us for the construction of a harbour at this place; but as we shall have occasion to show in the sequel that other situations possess greater advantages for the attainment of the objects pointed out by their Lordships' instructions, we do not consider it necessary to enter into any details of these suggestions.

Broadstairs.

From Margate we proceeded to Broadstairs. The harbour at this place is formed by a wooden pier, about 100 yards in length, extending from the northern side of a small bay.

The entrance faces south-west, but the harbour is much exposed to the sea, which is driven in by winds from the eastward.

At spring tides there is about 16 feet water at the pier-head, and 10 at neaps, but the whole harbour is dry at low water; and, during spring tides, nearly 100 yards outside the pier is left uncovered.

A plan was submitted to us by the harbour commissioners for constructing a larger harbour, by extending piers from the opposite extremities of the bay, 320 yards into the sea, by which eight feet in the entrance at low water might be obtained. But we do not consider it necessary to enter into further particulars of this project, as it does not appear to us that a work of such magnitude is required in this situation, or that the advantages anticipated would be commensurate with the expense.

The harbour is managed by commissioners, under an Act of Parliament passed in 1792.

Ramsgate.

Ramsgate harbour, which was the next place we visited, consists of an inner and outer basins, formed by substantial stone piers, extending 1,310 feet into the sea, and encloses an area of 42 acres.

The inner basin is used as a wet dock for vessels to load or unload their cargoes, &c., and contains a dry dock where vessels of 300 to 400 tons burthen can be repaired, &c.

The entrance of the outer harbour is 200 feet in width, and opens to the south-west.

The rise of average spring tides is from 13 to 14 feet at the pier-heads, and of neap tides nine feet, giving in the entrance 19 feet at high water of spring tides, and 16 of neaps.

For the purpose of scouring the outer harbour at low water, powerful sluices have been constructed through the cross wall of the inner basin, the discharge of water from which serves to keep open the channel to the inner basin and the gullies which extend round the harbour at the foot of the piers, in certain portions of which, near the entrance of the harbour, the depth increases to about six feet at low water.

The mud which remains in the middle of the harbour serves as grounding banks, and affords a soft bed on which vessels entering with loss of anchors and cables can take the ground in safety; and these banks are considered essential for the purpose.

A new communication between the outer and inner basins has lately been completed, the gates of which are 42 feet in width.

One of Morton's patent slips has also been laid down in the outer harbour, on which steam-vessels, &c. of too great beam to enter the graving dock in the inner basin can be hauled up and repaired.

The situation of this harbour appears to have been selected more from its position with reference to the Downs than from any local advantages afforded by the formation of the coast. There is no natural backwater, so essential in tidal harbours for the purpose of scouring, nor does the line of cliff offer shelter against any winds but those which blow from off the land; and yet in this situation, without one natural facility but that of a chalk foundation, a harbour has been constructed which, notwithstanding its imperfections, is undoubtedly the best on the south-eastern coast of England.

During gales from the southward and westward, which throw a heavy sea into the Downs, and render the anchorage insecure for heavily-laden coasters, and merchant vessels of the smaller classes frequently unprepared for riding in open roadsteads during heavy weather,—this harbour affords a place of shelter where vessels of considerable draught of water may run for protection at tide time.

By the accounts we received from the harbour-master of the number of vessels which have annually sought shelter from weather, &c. since the completion of the harbour, it may be inferred that the object for which it was constructed, viz. an asylum for ships in distress in the Downs, &c., has been to a certain extent attained.

No plans for the improvement of this harbour have been submitted to us; and from the nature of the bottom outside, which consists of chalk rock, with not above six feet water at some distance from the harbour's mouth, at low water spring tides, it is obviously incapable of being rendered accessible for vessels drawing more than that depth of water. It cannot, therefore, be considered a perfect harbour of refuge, nor is the situation eligible for the purposes pointed out in their Lordships' instructions.

The care and management of the harbour is placed, by Act of Parliament, in the hands of trustees.

Deal and Sandwich.

From Ramsgate we proceeded to Deal, where a deputation from that town and the borough of Sandwich waited upon us, and submitted to our inspection plans for the construction of a harbour on the beach, with docks, &c., to communicate with the latter town. The River Stour, which enters the sea through the Sandwich flats, being proposed to be converted into a backwater, for the purpose of scouring the entrance.

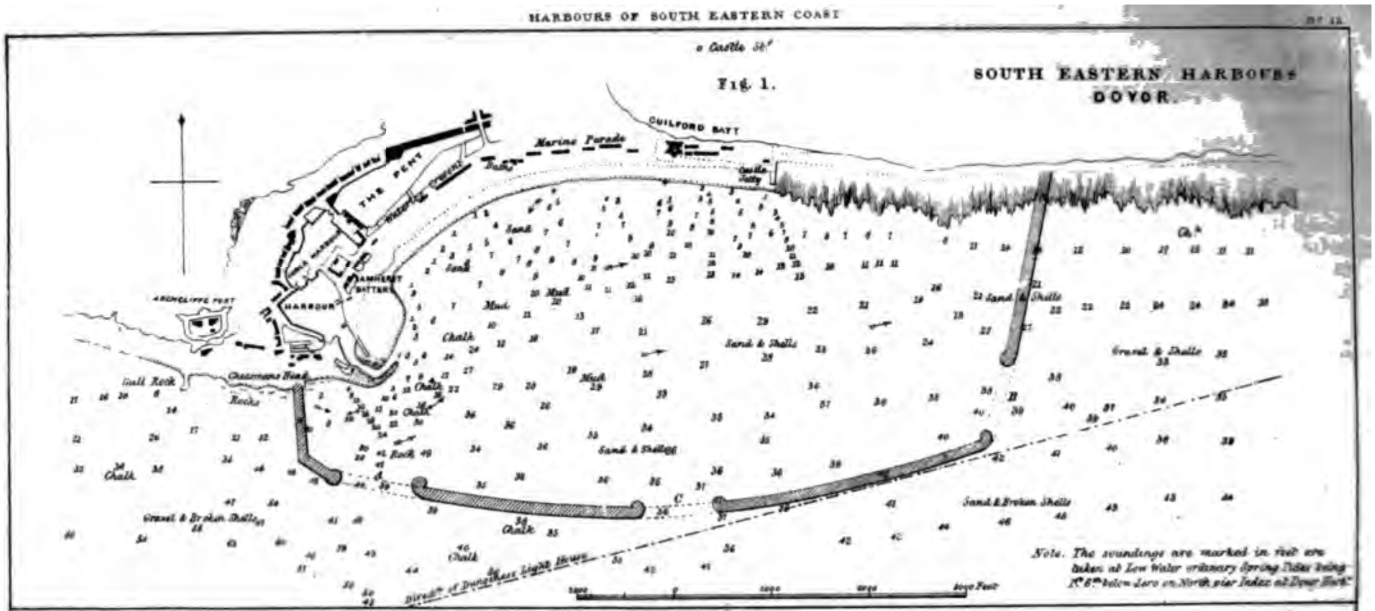
The scheme has been under contemplation for many years, but nothing has been undertaken towards carrying it into execution.

We thought it right, however, to inspect the coast in the neighbourhood of the site of the proposed harbour, to ascertain the feasibility or otherwise, by an extension of the plan, of rendering it subservient to the objects of our inquiry.

The shingle, which first makes its appearance about a mile to the northward of Sandown Castle, extends in a vast bank along the shore towards the South Foreland, and is continually moving by the action of the waves in the direction of the prevailing winds, and forming accumulations to the northward. This is an objection to the construction of a harbour on this part of the coast, and it is very doubtful whether vessels in distress in the Downs

Fig. 1.

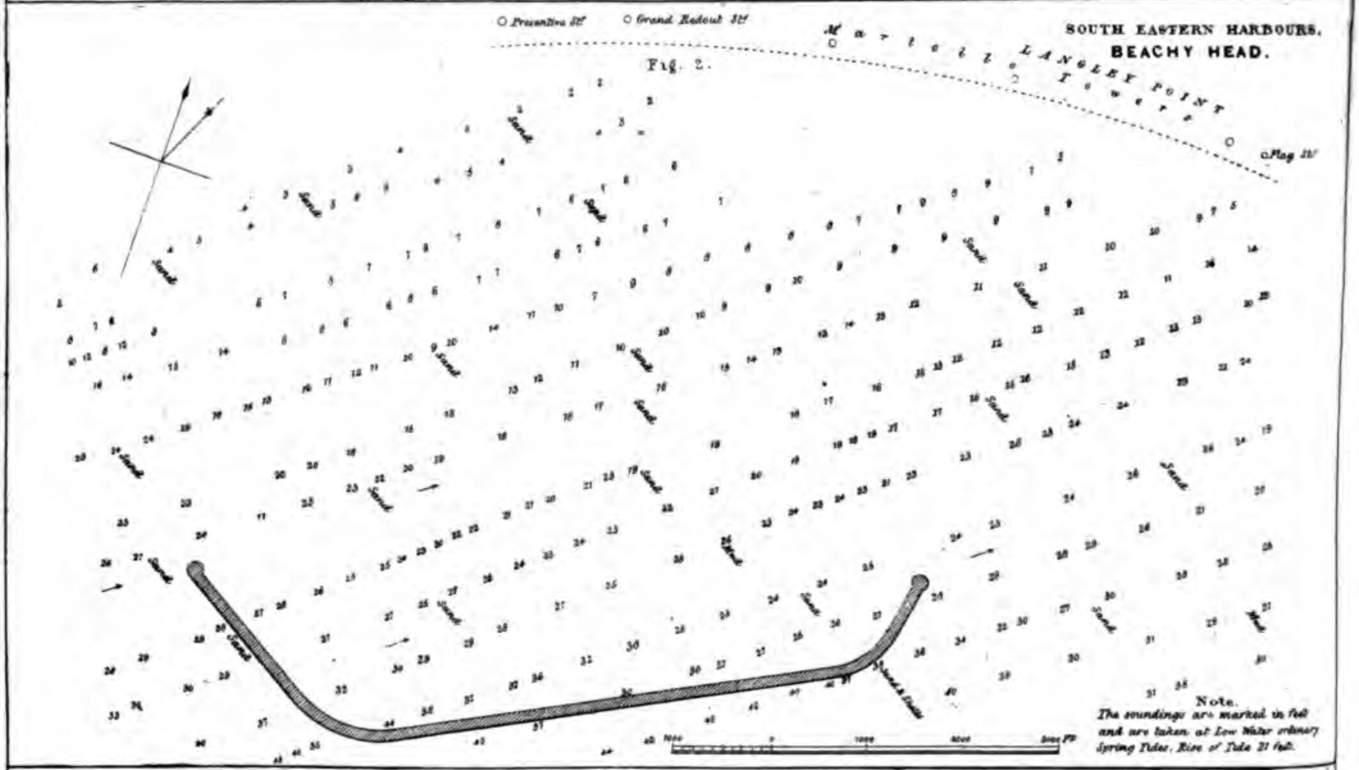
SOUTH EASTERN HARBOURS
DOVOR.



Note. The soundings are marked in feet are taken at Low Water ordinary Spring Tides being 1ft 6in below Zero on North pier Index at Dover Harb.

Fig. 2.

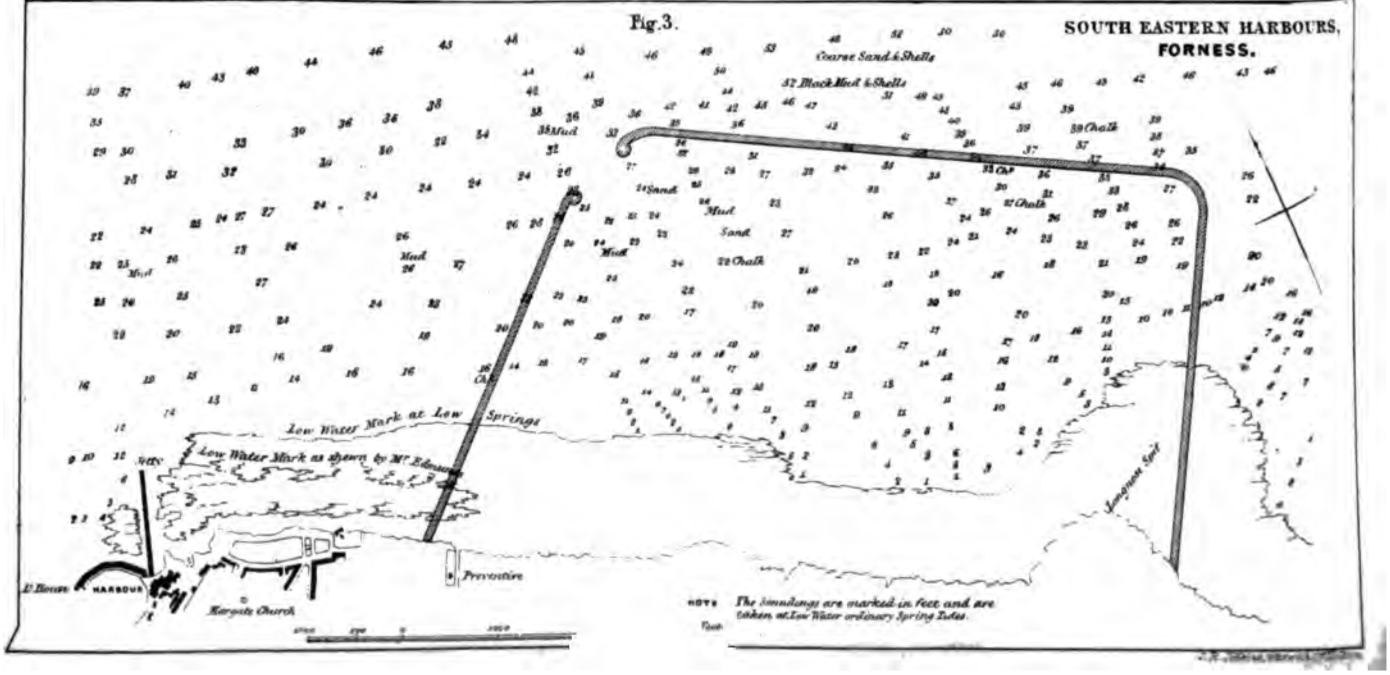
SOUTH EASTERN HARBOURS,
BEACHY HEAD.



Note.
The soundings are marked in feet and are taken at Low Water ordinary Spring Tides. Rise of Tide 21 feet.

Fig. 3.

SOUTH EASTERN HARBOURS,
FORNESS.



NOTE *The Soundings are marked in Feet and are taken at Low Water ordinary Spring Tides.*

To these vessels, therefore, some of the harbours at the present moment are open for several hours of each tide, and a few of them may be capable of being rendered more accessible by the removal of obstructions at their entrances, or by additional works.

This part of the coast possesses the advantage of a good rise of tide; and though the harbours are only available under special conditions, the numerous instances of shelter and protection afforded by each to ships in distress, serve to show their value in a national point of view, and the importance of not allowing them to fall to decay.

Although, therefore, we are convinced that none of them can be made perfect harbours of refuge, we still have considered them as falling within the scope of our inquiry; not as requiring from us specific details of the works which may be deemed desirable, but to explain briefly their present extent and capabilities, and to note generally what may have presented itself to us in the way of improvement; and we therefore propose to consider the objects of the inquiry under two heads, viz.: 1st, The state and capabilities of the existing harbours, &c., (in the order in which we visited them); and 2ndly, The situations best calculated for harbours of refuge, and as stations for armed steam-vessels in the event of war; confining to harbours for these latter objects, the necessary condition of being accessible at all times of tide.

The river Thames is usually considered to terminate at the Nore. From the Isle of Sheppey to Westgate Bay, the numerous sands and shoals which extend in all directions along the coast, prevent the approach of vessels of any size; and the cliffs, which consist of sand and clay, are gradually yielding to the action of the sea, and supply a constant source of materials for fresh accumulations.

We did not, therefore, consider it necessary to visit this part of the coast, where no harbours at present exist.

Margate.

Margate was the first place at which we landed after leaving the river.

The harbour is situated in a small bay between two extensive flats of chalk rocks, the Nayland on the west, and the Fulsam on the east, both of which are covered before high water. The artificial harbour is formed by a stone pier, which commences on the eastern side of the bay (around which the town is situated), and extends 800 feet to the westward, in an irregular curve, leaving the entrance open to the north-west.

The rise of average spring tides at the pier-head, is about 13 feet, and that of neap tides eight feet; but spring tides ebb outside of the pier-head, and leave the harbour dry at low water. A wooden jetty has been run out from the root of the pier, over the Fulsam rocks, to the distance of 1,100 feet, for the convenience of passengers, &c., landing from or embarking in the steam-packets at low water.

The pier and jetty belong to a joint-stock company, the chairman, surveyor, and harbour-master of which attended us, and gave us the information we required.

It is evident that the harbour in its present state possesses none of the requisites of a harbour of refuge, and can only be considered valuable, in a national point of view, as affording the means of supplying pilots, anchors, and cables, &c., to vessels driven into the roads in distress.

The surveyor, by order of the directors of the pier and harbour company, prepared and submitted to us a design for constructing a harbour of refuge at this place, by extending curved piers upon the Nayland and Fulsam rocks; enclosing an area of considerable extent on and around the site of the present harbour, and leaving an entrance of 300 or 400 feet in width towards the north-east, with 16 feet depth of water at the mouth.

The expense of such a work is estimated by the surveyor at 275,000*l.*; but the cost of deepening the harbour is not included in this sum; and as the bottom rises gradually to the beach, the area possessing even 8 feet water would be very limited, and considerable excavations would be necessary to render it available to any extent.

A second design was submitted to us, said to be formed on a plan suggested by the late Mr. Rennie, who is quoted as having thought highly of the situation for a harbour of refuge. It consisted of an outer harbour of less dimensions than the one proposed by the directors of the pier and harbour company, enclosed by walls; and an inner basin with gates to shut in the water at flood-tide, for the purpose of clearing the entrance at low water.

The power of sluicing at so great a distance as that proposed in this plan, could only be applied with advantage to a surface dry, or nearly so, at low water; and the idea of keeping a deep-water harbour of any useful width, clear by means of such sluicing, appears to us to be impracticable.

Several other plans were brought before us for the construction of a harbour at this place; but as we shall have occasion to show in the sequel that other situations possess greater advantages for the attainment of the objects pointed out by their Lordships' instructions, we do not consider it necessary to enter into any details of these suggestions.

Broadstairs.

From Margate we proceeded to Broadstairs. The harbour at this place is formed by a wooden pier, about 100 yards in length, extending from the northern side of a small bay.

The entrance faces south-west, but the harbour is much exposed to the sea, which is driven in by winds from the eastward.

At spring tides there is about 16 feet water at the pier-head, and 10 at neaps, but the whole harbour is dry at low water; and, during spring tides, nearly 100 yards outside the pier is left uncovered.

A plan was submitted to us by the harbour commissioners for constructing a larger harbour, by extending piers from the opposite extremities of the bay, 320 yards into the sea, by which eight feet in the entrance at low water might be obtained. But we do not consider it necessary to enter into further particulars of this project, as it does not appear to us that a work of such magnitude is required in this situation, or that the advantages anticipated would be commensurate with the expense.

The harbour is managed by commissioners, under an Act of Parliament passed in 1792.

Ramsgate.

Ramsgate harbour, which was the next place we visited, consists of an inner and outer basins, formed by substantial stone piers, extending 1,310 feet into the sea, and encloses an area of 42 acres.

The inner basin is used as a wet dock for vessels to load or unload their cargoes, &c., and contains a dry dock where vessels of 300 to 400 tons burthen can be repaired, &c.

The entrance of the outer harbour is 200 feet in width, and opens to the south-west.

The rise of average spring tides is from 13 to 14 feet at the pier-heads, and of neap tides nine feet, giving in the entrance 19 feet at high water of spring tides, and 16 of neaps.

For the purpose of scouring the outer harbour at low water, powerful sluices have been constructed through the cross wall of the inner basin, the discharge of water from which serves to keep open the channel to the inner basin and the gullies which extend round the harbour at the foot of the piers, in certain portions of which, near the entrance of the harbour, the depth increases to about six feet at low water.

The mud which remains in the middle of the harbour serves as grounding banks, and affords a soft bed on which vessels entering with loss of anchors and cables can take the ground in safety; and these banks are considered essential for the purpose.

A new communication between the outer and inner basins has lately been completed, the gates of which are 42 feet in width.

One of Morton's patent slips has also been laid down in the outer harbour, on which steam-vessels, &c. of too great beam to enter the graving dock in the inner basin can be hauled up and repaired.

The situation of this harbour appears to have been selected more from its position with reference to the Downs than from any local advantages afforded by the formation of the coast. There is no natural backwater, so essential in tidal harbours for the purpose of scouring, nor does the line of cliff offer shelter against any winds but those which blow from off the land; and yet in this situation, without one natural facility but that of a chalk foundation, a harbour has been constructed which, notwithstanding its imperfections, is undoubtedly the best on the south-eastern coast of England.

During gales from the southward and westward, which throw a heavy sea into the Downs, and render the anchorage insecure for heavily-laden coasters, and merchant vessels of the smaller classes frequently unprepared for riding in open roadsteads during heavy weather,—this harbour affords a place of shelter where vessels of considerable draught of water may run for protection at tide time.

By the accounts we received from the harbour-master of the number of vessels which have annually sought shelter from weather, &c. since the completion of the harbour, it may be inferred that the object for which it was constructed, viz. an asylum for ships in distress in the Downs, &c., has been to a certain extent attained.

No plans for the improvement of this harbour have been submitted to us; and from the nature of the bottom outside, which consists of chalk rock, with not above six feet water at some distance from the harbour's mouth, at low water spring tides, it is obviously incapable of being rendered accessible for vessels drawing more than that depth of water. It cannot, therefore, be considered a perfect harbour of refuge, nor is the situation eligible for the purposes pointed out in their Lordships' instructions.

The care and management of the harbour is placed, by Act of Parliament, in the hands of trustees.

Deal and Sandwich.

From Ramsgate we proceeded to Deal, where a deputation from that town and the borough of Sandwich waited upon us, and submitted to our inspection plans for the construction of a harbour on the beach, with docks, &c., to communicate with the latter town. The River Stour, which enters the sea through the Sandwich flats, being proposed to be converted into a backwater, for the purpose of scouring the entrance.

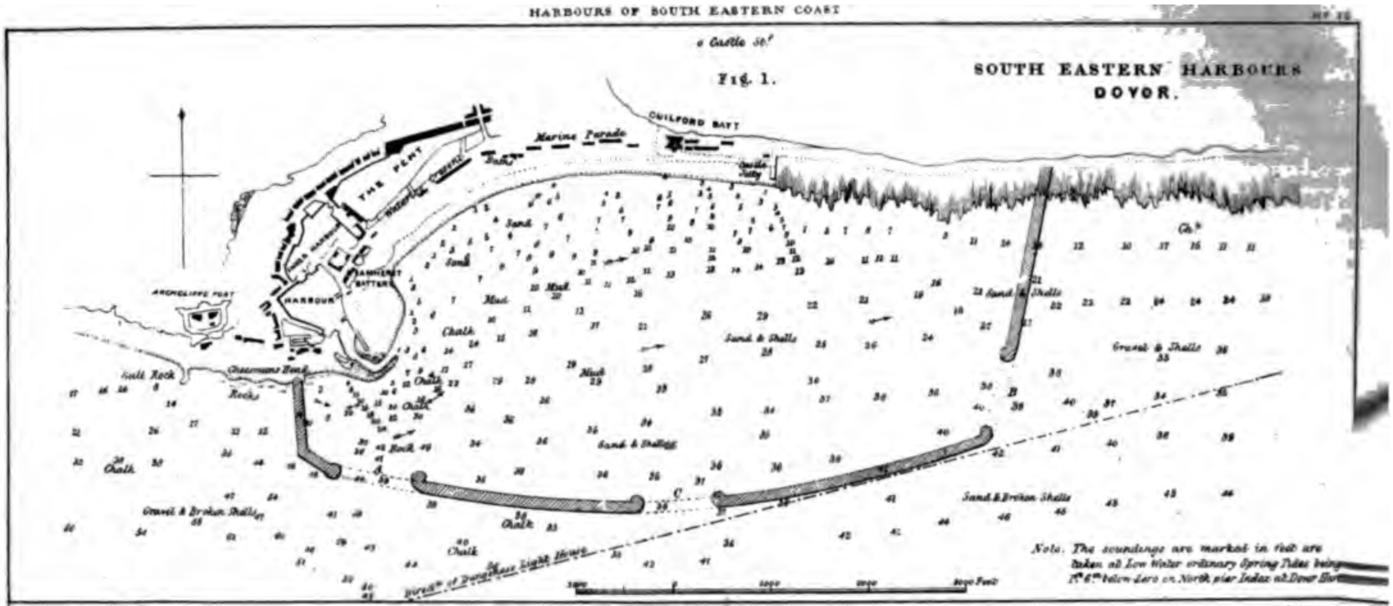
The scheme has been under contemplation for many years, but nothing has been undertaken towards carrying it into execution.

We thought it right, however, to inspect the coast in the neighbourhood of the site of the proposed harbour, to ascertain the feasibility or otherwise, by an extension of the plan, of rendering it subservient to the objects of our inquiry.

The shingle, which first makes its appearance about a mile to the northward of Sandown Castle, extends in a vast bank along the shore towards the South Foreland, and is continually moving by the action of the waves in the direction of the prevailing winds, and forming accumulations to the northward. This is an objection to the construction of a harbour on this part of the coast, and it is very doubtful whether vessels in distress in the Downs

Fig. 1.

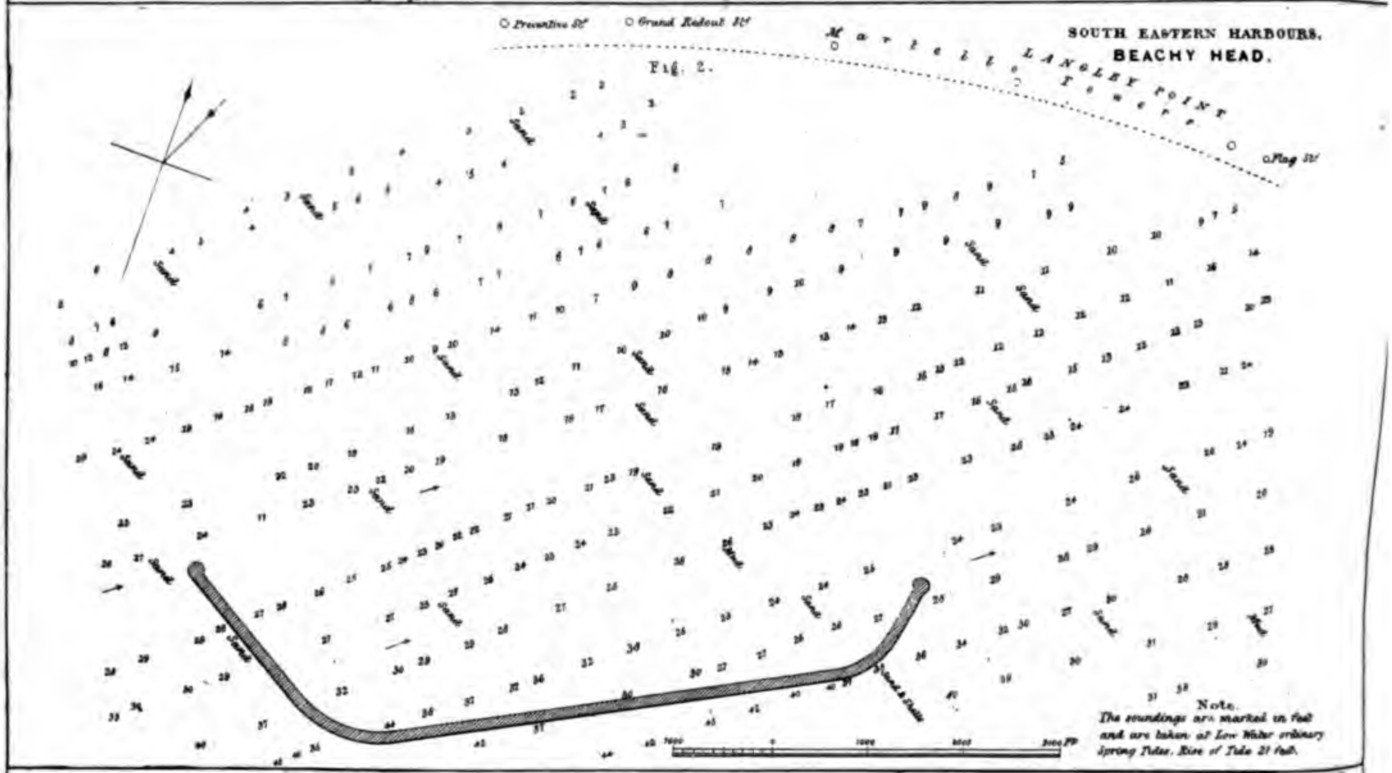
SOUTH EASTERN HARBOURS
DOVOR.



Note. The soundings are marked in feet are taken at Low Water ordinary Spring Tides being 1ft 6in below Zero on North pier Index at Dover Har

Fig. 2.

SOUTH EASTERN HARBOURS.
BEACHY HEAD.

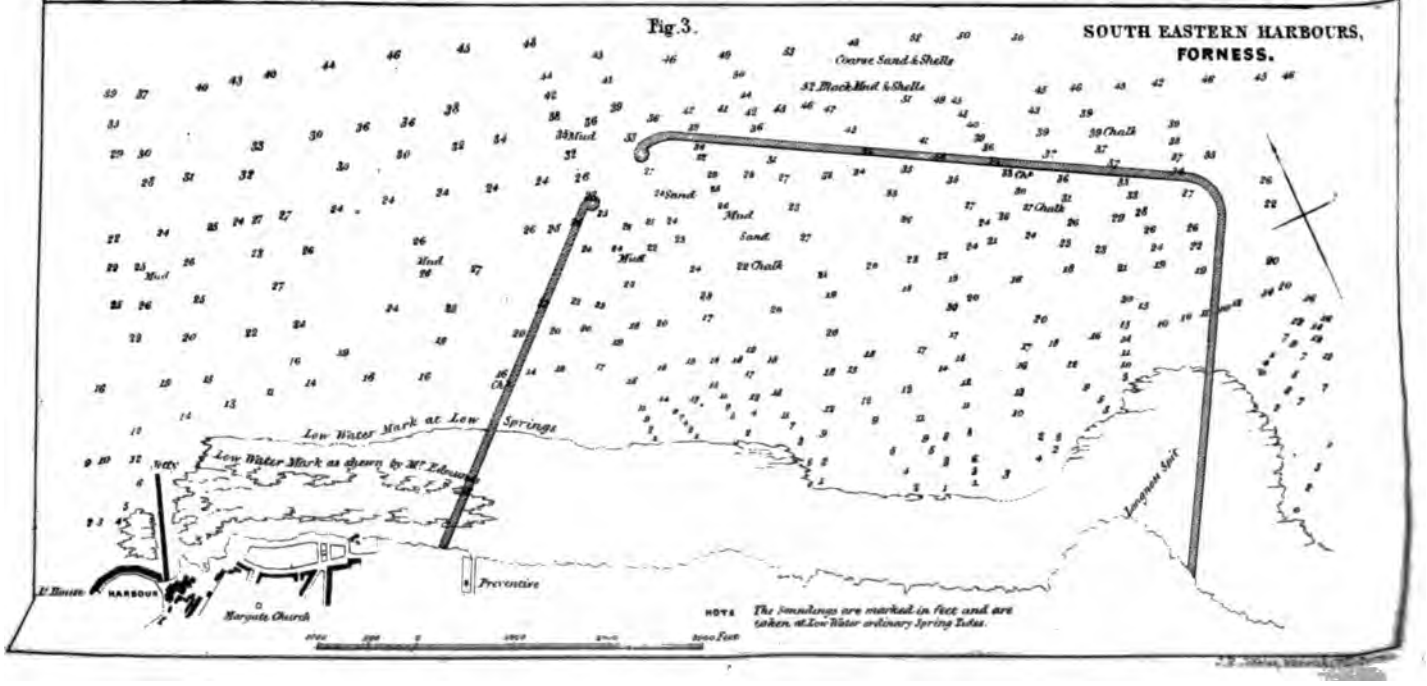


Note.

The soundings are marked in feet and are taken at Low Water ordinary Spring Tides. Rise of Tide 21 feet.

Fig. 3.

SOUTH EASTERN HARBOURS,
FORNESS.



NOTE *The Soundings are marked in feet and are taken at Low Water ordinary Spring Tides.*

structed on the eastern side, and embankments have been thrown up on the western side, leaving an entrance between of 160 feet in width.

The average rise of spring tides is about 17 feet, and during neap tides from 9 to 12 feet at the pier-head, whilst the lift in the bay is 22 feet. At low water the harbour is left dry.

The depth of the channel up the river decreases gradually to the town, where there is 14 feet water at the top of spring tides, but during neaps seldom above nine feet.

The approach from the bay to the entrance of the harbour is very intricate and difficult, especially to sailing vessels, arising from the sandbanks and the tortuous course of the channel.

The shingle, which extends on both sides of the harbour's mouth, is accumulated at the entrance with winds either from the westward or eastward of south, and forms banks on either side (according to the prevalence of the wind), which, in combination with sand, serve to block out the sea, and render the channel crooked and uncertain.

There can be no doubt that these natural causes have mainly contributed to the deterioration of this port, formerly of greater capacity, and a place of importance; but at the same time it should be observed, that the encroachments which have been made from time to time on the original extent of the river, have proved a powerful cause of injury. Individuals interested in the maintenance and improvement of the harbour are fully aware of this fact, and the contests which arise on the subject of drainage, between the landowners and those concerned in the navigation of the river, have become a fruitful source of litigation. Extensive low lands over which the river formerly flowed at high water, have been reclaimed for the purposes of agriculture, and the powerful backwater which was thereby acquired, and operated as a scour during the ebb to clear the channel and keep the entrance open, has been diminished, and at the present moment is almost destroyed, by the erection of sluice-gates across the river, a little distance above the town, for the purposes of draining the lands at low water, and of preventing the flow of water up its natural channel, which, if not thus obstructed, would again inundate the lands below the level of high water.

No cause has operated more extensively to injure the entrances of harbours of this country, than excluding the tidal waters from lands below the level of high water, which served as natural reservoirs at flood tide, and were the means of affording a powerful discharge during the ebb. The portion of the river between the embankments formed for the purpose of excluding the high water, is often benefited by the contraction of the channel, and the consequent acceleration of the current, but the communication with the sea below such embankments is injured, and nothing more deserves the vigilant attention of Government, or of the parties entrusted with the conservancy of harbours, than the subject of encroachments, which are usually made gradually and silently, as dictated by private interest, and are difficult afterwards to remove.

At the present moment a stone wall is in progress of erection from the eastern pier-head, and is intended to be carried out as far as low water, across the extensive flats which form the bar at the entrance, in a south-half-east direction. By this means the water, which on its exit from the harbour spreads over the sandbanks and forms a crooked passage as it meets with obstructions, and is deflected from side to side, will be directed in a straight line; and there can be no doubt that the continuation and completion of this stone groin will render the navigation of the entrance less difficult, and at the same time enable vessels of greater draught of water than at present to enter at tide-time.

By straightening and deepening the channel up to the wharfs or quays at the town, a considerable improvement may also be effected; but from the limited means at the disposal of the commissioners, it will necessarily take a long time to complete these works.

Hastings.

No harbour at present exists between Rye and Newhaven; but the construction of one at Hastings having been frequently contemplated, we visited that town. The mayor and other gentlemen of the place attended, and laid before us several plans which had been prepared for the purpose; and Colonel Williams, late of the Royal Engineers, afforded us much information, together with his suggestions on the subject.

We do not, however, consider it necessary to enter into the particulars of these plans, as a few remarks will show the unfavourable nature of the situation for the objects of our inquiry.

The coast runs, with little deviation, in a straight line, nearly east and by south, and west and by north, and is entirely exposed to the prevailing southerly and westerly winds. There is no natural backwater, nor the facility of making an artificial one to any useful extent; the shore composed of shingle, and not above four fathoms water at a distance of three quarters of a mile from the beach, which would give but a limited area of 12 feet water (at low water), in proportion to the size of the harbour, were piers to be carried out to such an extent.

A small tidal harbour for the use of trading vessels, &c. would, no doubt, be a valuable adjunct to the town and neighbourhood, but we do not consider the situation adapted for any national work.

Cuxmere Haven.

At Cuxmere Haven, which is situated on the western side of Beachy Head, there is no artificial harbour. The shingle beach crosses the entrance and rises several feet above low water, and the interior of the haven is left dry at three-quarters ebb. We did not consider it necessary to land at this place, but proceeded round the coast to Newhaven.

Newhaven.

The harbour of Newhaven is formed in the channel of the river Ouse, at its entrance into the sea, by wooden piers carried out in a southerly direction across the beach. The river is navigable as far as the town of Lewes, and open to the flow and ebb of the tide for four miles further up the stream, or twelve miles altogether, and affords a powerful backwater for scouring the entrance.

The average rise of spring tide at the harbour's mouth is from 19 to 20 feet, and of neap tides about 14 to 15 feet. The bar, however, is left dry at low water spring tides, but within the piers there is about two feet water at such times, and this depth continues uniform for a mile up the channel.

The distance between the pier-heads is only 106 feet. On the western side of the harbour, the wooden pier, which extends about 250 yards, has been continued inwards by a stone embankment nearly three-quarters of a mile in a straight line; and the bar, which formerly extended from the western side nearly across the mouth of the harbour, has been considerably reduced since the completion of this work, the extension of the eastern pier, and other improvements which have of late been made in straightening and deepening the river above the town.

During the flood-tide and fine weather the harbour is easy of access, from the indraught and eddy-tide which set towards the mouth; but, from the rapidity of the stream during the ebb, it is not considered safe for a sailing vessel to enter, and the flag at the pier-head is in consequence lowered at high water.

This harbour appears to be one of considerable value, and to possess facilities for further improvements; and there can be little doubt that an additional depth of water might be obtained by the adoption of judicious measures.

The observations we had occasion to make on the subject of encroachments, when treating of Rye, are equally applicable to this harbour; but great care should be observed, in straightening the river, to exclude the waters only from such places as afford a loose soil and serve to slit up the channel.

The piers at present only extend to the line of low water on the beach; and to render the harbour more available, it would be advisable to continue them some distance into the sea, and at the same time, by deepening and enlarging the river above the harbour, a larger body of water would flow up at tide-time, and give a commensurate discharge on the ebb. A dock or pent might be constructed on the low ground on the western side, between the entrance and the town, called Sleeper's Hole; and a groin extended from Burrow Head into the sea, would facilitate the ingress and egress of vessels, by protecting the harbour's mouth from the swell occasioned by south-westerly winds, and serve to keep off the approach of shingle to the entrance. The expense, however, of these works cannot be stated without previous minute surveys, &c.

The harbour is managed by trustees.

Shoreham.

Shoreham, at the mouth of the river Adur, was the next harbour we visited.

The river, which formerly entered the sea nearly at right angles with the line of coast, has been gradually diverted from its original exit by the shingle, which constantly travels from the westward, and until a few years ago flowed along the shore in an easterly direction for three or four miles, before it at length found its way through the shingle bank into the sea.

This accumulation of shingle, consolidated by the alluvial deposit from the river, now forms an embankment between the river and the sea, varying from 200 to upwards of 300 yards in width; and an area of considerable extent is left within, into which the sea flows.

The entrance which existed at the eastern extremity of this estuary, once the river's mouth, has been blocked up, and an artificial channel has been cut through the shingle embankment about a mile from the town of Shoreham. This opening is preserved by wooden piers (formed of piles), 218 feet apart, which run in a south-south-west direction across the shingle into the sea. Within this entrance a third pier has been built out from the shore nearly across the harbour, for the purpose of directing the waters on the ebb, from the eastern and western sides of the inlet, directly to the mouth. The great body of water which thus ebbs and flows through the entrance serves to keep the channel open; and though the width is so considerable, the stream runs between the pier-heads at the rate of five or six miles an hour. The harbour's mouth is nevertheless subject to a bar, which rises occasionally above the low water level, and shifts its position from 60 to 160 feet from the pier-heads.

The lift of spring tides is about 15 feet, and neaps about nine feet. The depth of water over the bar at high water is from 14 to 17 feet, according to the tides and state of the bar.

From its proximity to Brighton, this harbour is of importance to the local trade. We were informed that upwards of a thousand vessels enter annually. It is capable of improvements; the most obvious of which are, the extension of the present piers and the filling in of their centres with rubble, which are now partly open, and admit the shingle into the entrance.

The interior of the harbour might, at the same time, be deepened and generally improved, but we do not consider it capable of being converted into a deep-water harbour for the purposes pointed out by their Lordships.

The harbour is the property of a joint-stock company, established by Act of Parliament.

could make use of one in this situation. These reasons appear to us to render the plan ineligible.

The situation to which we next directed our attention was the space within the breaksand, and the expediency of enclosing the "Small Downs" and the area within, by extending a breakwater along the sand, and a pier from the shore. The magnitude and extent, however, of such a work, which would require a breakwater and pier of upwards of five miles in length, the small depth of water at the northern entrance, and the uncertain nature of the foundation, induce us to abandon the idea of a harbour of refuge at this place.

Dover.

We next visited Dover. This harbour, from its proximity to the French coast, and as the principal port of communication between Great Britain and the Continent, has been regarded at all times as a place of the greatest importance.

We shall have occasion to refer to the situation in the latter part of this Report; and it will only be necessary in this place to give a brief description of the harbour in its present state.

It consists of an outer and an inner basin, with a backwater which opens into the latter, called the Pent.

The outer harbour contains an area of seven acres and a half, the inner basin six acres and a quarter, and the pent 11 acres and a half. A wet dock, of an acre and a half, opens into the western side of the outer harbour, which again communicates with a graving or repairing dock.

The entrance between the pier-heads (which are partly formed of stone and brickwork faced with wooden piles) is 110 feet in width, and opens to the south-south-east.

The rise of average spring tides is from 18 to 19 feet, and of neap tides from 12 to 13 feet; but the depth at high water in the harbour at spring tides is only 17 to 18 feet, and in the basin 16 to 17 feet, and about three feet less during the neaps.

The harbour is therefore left dry at low water.

The bottom consists of chalk, on which a deposit of mud in certain places has accumulated, but not of sufficient depth to enable heavily-laden vessels to take the ground with safety, especially during easterly winds, when, from the confined area of the outer harbour, and the rebound from the upright walls, there is a considerable agitation in the water.

During south-westerly gales, vessels experience difficulty in entering, from the heavy sea to which the harbour's mouth is exposed; and another formidable obstacle arises from the shingle bar, which winds from this quarter throw up across the entrance, and which at times has rendered the harbour inaccessible for several weeks together. Numerous plans and suggestions have been devised, and large sums of money expended for remedying this evil.

Formerly there were only three sluices or culverts, communicating by means of a pipe with the inner basin; but since 1837, a new and expensive work has been completed, consisting of a brick reservoir in the western pier, communicating, by means of a tunnel 30 feet in width and 16 in height, with the inner basin and pent. From this reservoir, five new sluices, seven feet in diameter, lead to the extremity of the pier-head; and from the powerful volume of water thus discharged, and the impetus acquired by the proximity of the reservoir, it has generally been found sufficient, with the assistance of the sluices in the cross wall, between the basin and outer harbour, to remove the shingle from the pier-head, and keep the channel clear to a level below that of the harbour's bottom.

We have been informed that since the construction of this work until January last, no instance occurred of Her Majesty's steam-packets being prevented from entering the harbour at tide-time, in consequence of the bar. But during the violent gales which took place in the latter end of the month of January and beginning of February in this year (1840), the Government packets were ordered to proceed to the Downs, to avoid the liability of being shut into the harbour by an accumulation of shingle and the heavy sea at the entrance. There were, however, but three days during which vessels were actually excluded.

It should be observed that these sluices, though efficacious to a certain extent, are not capable of removing the obstruction altogether. The force of the water, which at its exit from the culverts is very great, loses its impetus as it spreads over a larger surface, and forces the shingle to a comparatively small distance, where it is liable to form banks beyond the power of the sluices.

With regard to the improvements which might be made to this harbour, it appears to us that the general enlargement of the harbour, the inner basin and pent, and the widening of the internal communications, would be most desirable, as well as the extension of the stone groin, called Cheeseman's Head, on the western side of the harbour's entrance. But these suggestions, so far as regards the entrances, will be much modified in the event of a harbour of refuge being constructed at this place.

Various plans and suggestions for the improvement of the present, as well as for the formation of a new harbour, were submitted to us by Colonel Williams, Lieutenant Worthington, Mr. Jeffery, Mr. Stuart, Mr. Tait, Captain Meriton, and several other gentlemen; but as we shall have occasion to recommend a plan for the attainment of the objects of our inquiry, in the subsequent part of this report, we do not consider it necessary to enter into the details of these propositions.

The harbour-master and other officers of Dover, and pilots belonging to this, as well as to the other Cinque Ports, waited upon us by order of his Grace the Lord Warden, and gave us any information we required.

The habour is managed by commissioners, of whom the Lord Warden is chairman, *ex officio.*

Folkstone.

From Dover we proceeded to Folkstone. This harbour was constructed under an Act of Parliament in 1809, by a joint-stock company, to whom the property belongs, but at present it is in the hands of the Exchequer Bills Loan Commissioners.

The harbour, which is entirely artificial, is formed by rubble-stone piers, and encloses an area of 14 acres. The western arm extends in a south-south-west direction 140 yards across the beach, and is united with the main pier, which is carried in a straight line east and by south about 317 yards. A projecting pier has since been run out from the shore, on the eastern side, towards the south-west, 236 yards, leaving an entrance of 123 feet in width, open to the east and by south.

A groin has been constructed near the eastern extremity of the main pier, which extends at right angles 130 feet seaward, for the purpose of preventing the shingle from obstructing the harbour's mouth. This, however, has not overcome the evil; for the shingle having accumulated along the southern side of the main pier to the line of extension of the horn, finds its way round the extremity, and creates a bar nearly across the entrance.

The rise of spring tides averages about 18 to 20 feet, and neap tides from 12 to 14 feet, but the harbour is left dry at low water; and the greater part of the interior is blocked up by a bank of shingle rising to the height of several feet above high water, and leaving only a channel of inconsiderable width along the side of the main pier.

A small stream is pent up at the north-western side of the harbour, for the purpose of scouring at low water; and with the assistance of manual labour, in addition to this very inadequate backwater, the channel is kept open so as to allow vessels of 10 to 12 feet draught to come alongside of the main pier at the top of high water.

This harbour, in its present form, is not capable by any improvements of being made available for the purposes of our inquiry, and we do not consider the situation eligible for the construction of a deep-water harbour.

From Folkstone we proceeded to Hythe, and inspected the coast to Dungeness, No harbours at present exist between these places, and from the nature of the coast, the situation is inapplicable for their formation; but several plans having been submitted to us for the construction of a harbour at Dungeness, we landed for the purpose of examining the beach, and ascertaining the practicability or otherwise of the propositions.

Vice-Admiral Sir Edward Owen, in a communication which he subsequently addressed to the Committee, stated, that "during the late war, when the presence of the flotilla and the encampment of troops on the opposite coast demanded unceasing vigilance, and the employment of many armed cruisers of the smallest description, the inconvenience of sending these vessels to Sheerness for the purposes of trivial repairs, and payment of the men, &c., was greatly felt, both in the loss of their immediate services, and from the interruption to the more regular and important arrangements of defence; and Dungeness being then considered the rendezvous of greatest moment, he contemplated the formation of a basin within the shingle, in a position between No. 2 battery on the east, and No. 4 battery on the west, with an outlet on either side, by which vessels might enter or put to sea when their services were required."

The propositions submitted to us by Mr. Potter and Mr. Douglass were of a similar nature; and there can be little doubt, from the prominent position of this extensive point of land, and the anchorage it affords to vessels on either side, according to the direction of the wind, that the situation is desirable for a harbour.

The shore at the southern extremity is extremely steep, and descends at once into deep water; but the whole promontory consists of vast accumulation of shingle, constantly increasing and extending seaward; and were a basin to be constructed in the centre, the entrances on either side would speedily be choked up, and, in our opinion, no scouring power would be able to keep the channels clear below the level of low water. However desirable, therefore, the construction of a deep-water harbour may be in this situation, the physical obstacles to its formation and maintenance appear to us to render the scheme impracticable.

In corroboration of this opinion, and the constant motion and increase of shingle, it is worthy of remark, that the site of the present lighthouse, when first erected in 1792, was only 100 yards from the sea, and now, in the lapse of 47 years, the beach has extended 118 yards to the southward, leaving the lighthouse 218 yards inland.

The former lighthouse, which was pulled down when the present one was completed, was at that time upwards of 640 yards from the extremity of the Ness,

Rye.

Rye, which was the next harbour we visited in our progress round the coast, is situated in the bight of the bay formed by Fairlight Head, on the western side, and Dungeness on the eastern. The harbour is formed in the channel of the river Rother, at the point where it enters the sea, after receiving the waters of the Tillingham and the Bride, two small rivers which unite with it near the town of Rye. A wooden pier of piles has been constructed on the eastern side, and embankments have been thrown up on the western side, leaving an entrance between of 160 feet in width.

The average rise of spring tides is about 17 feet, and during neap tides from 9 to 12 feet at the pier-head, whilst the lift in the bay is 22 feet. At low water the harbour is left dry.

The depth of the channel up the river decreases gradually to the town, where there is 14 feet water at the top of spring tides, but during neaps seldom above nine feet.

The approach from the bay to the entrance of the harbour is very intricate and difficult, especially to sailing vessels, arising from the sandbanks and the tortuous course of the channel.

The shingle, which extends on both sides of the harbour's mouth, is accumulated at the entrance with winds either from the westward or eastward of south, and forms banks on either side (according to the prevalence of the wind), which, in combination with sand, serve to block out the sea, and render the channel crooked and uncertain.

There can be no doubt that these natural causes have mainly contributed to the deterioration of this port, formerly of greater capacity, and a place of importance; but at the same time it should be observed, that the encroachments which have been made from time to time on the original extent of the river, have proved a powerful cause of injury. Individuals interested in the maintenance and improvement of the harbour are fully aware of this fact, and the contests which arise on the subject of drainage, between the landowners and those concerned in the navigation of the river, have become a fruitful source of litigation. Extensive low lands over which the river formerly flowed at high water, have been reclaimed for the purposes of agriculture, and the powerful backwater which was thereby acquired, and operated as a scour during the ebb to clear the channel and keep the entrance open, has been diminished, and at the present moment is almost destroyed, by the erection of sluice-gates across the river, a little distance above the town, for the purposes of draining the lands at low water, and of preventing the flow of water up its natural channel, which, if not thus obstructed, would again inundate the lands below the level of high water.

No cause has operated more extensively to injure the entrances of harbours of this country, than excluding the tidal waters from lands below the level of high water, which served as natural reservoirs at flood tide, and were the means of affording a powerful discharge during the ebb. The portion of the river between the embankments formed for the purpose of excluding the high water, is often benefited by the contraction of the channel, and the consequent acceleration of the current, but the communication with the sea below such embankments is injured, and nothing more deserves the vigilant attention of Government, or of the parties entrusted with the conservancy of harbours, than the subject of encroachments, which are usually made gradually and silently, as dictated by private interest, and are difficult afterwards to remove.

At the present moment a stone wall is in progress of erection from the eastern pier-head, and is intended to be carried out as far as low water, across the extensive flats which form the bar at the entrance, in a south-half-east direction. By this means the water, which on its exit from the harbour spreads over the sandbanks and forms a crooked passage as it meets with obstructions, and is deflected from side to side, will be directed in a straight line; and there can be no doubt that the continuation and completion of this stone groin will render the navigation of the entrance less difficult, and at the same time enable vessels of greater draught of water than at present to enter at tide-time.

By straightening and deepening the channel up to the wharfs or quays at the town, a considerable improvement may also be effected; but from the limited means at the disposal of the commissioners, it will necessarily take a long time to complete these works.

Hastings.

No harbour at present exists between Rye and Newhaven; but the construction of one at Hastings having been frequently contemplated, we visited that town. The mayor and other gentlemen of the place attended, and laid before us several plans which had been prepared for the purpose; and Colonel Williams, late of the Royal Engineers, afforded us much information, together with his suggestions on the subject.

We do not, however, consider it necessary to enter into the particulars of these plans, as a few remarks will show the unfavourable nature of the situation for the objects of our inquiry.

The coast runs, with little deviation, in a straight line, nearly east and by south, and west and by north, and is entirely exposed to the prevailing southerly and westerly winds. There is no natural backwater, nor the facility of making an artificial one to any useful extent; the shore composed of shingle, and not above four fathoms water at a distance of three quarters of a mile from the beach, which would give but a limited area of 12 feet water (at low water), in proportion to the size of the harbour, were piers to be carried out to such an extent.

A small tidal harbour for the use of trading vessels, &c. would, no doubt, be a valuable adjunct to the town and neighbourhood, but we do not consider the situation adapted for any national work.

Cuxmere Haven.

At Cuxmere Haven, which is situated on the western side of Beachy Head, there is no artificial harbour. The shingle beach crosses the entrance and rises several feet above low water, and the interior of the haven is left dry at three-quarters ebb. We did not consider it necessary to land at this place, but proceeded round the coast to Newhaven.

Newhaven.

The harbour of Newhaven is formed in the channel of the river Ouse, at its entrance into the sea, by wooden piers carried out in a southerly direction across the beach. The river is navigable as far as the town of Lewes, and open to the flow and ebb of the tide for four miles further up the stream, or twelve miles altogether, and affords a powerful backwater for scouring the entrance.

The average rise of spring tide at the harbour's mouth is from 19 to 20 feet, and of neap tides about 14 to 15 feet. The bar, however, is left dry at low water spring tides, but within the piers there is about two feet water at such times, and this depth continues uniform for a mile up the channel.

The distance between the pier-heads is only 106 feet. On the western side of the harbour, the wooden pier, which extends about 250 yards, has been continued inwards by a stone embankment nearly three-quarters of a mile in a straight line; and the bar, which formerly extended from the western side nearly across the mouth of the harbour, has been considerably reduced since the completion of this work, the extension of the eastern pier, and other improvements which have of late been made in straightening and deepening the river above the town.

During the flood-tide and fine weather the harbour is easy of access, from the indraught and eddy-tide which set towards the mouth; but, from the rapidity of the stream during the ebb, it is not considered safe for a sailing vessel to enter, and the flag at the pier-head is in consequence lowered at high water.

This harbour appears to be one of considerable value, and to possess facilities for further improvements; and there can be little doubt that an additional depth of water might be obtained by the adoption of judicious measures.

The observations we had occasion to make on the subject of encroachments, when treating of Rye, are equally applicable to this harbour; but great care should be observed, in straightening the river, to exclude the waters only from such places as afford a loose soil and serve to slit up the channel.

The piers at present only extend to the line of low water on the beach; and to render the harbour more available, it would be advisable to continue them some distance into the sea, and at the same time, by deepening and enlarging the river above the harbour, a larger body of water would flow up at tide-time, and give a commensurate discharge on the ebb. A dock or pent might be constructed on the low ground on the western side, between the entrance and the town, called Sleeper's Hole; and a groin extended from Burrow Head into the sea, would facilitate the ingress and egress of vessels, by protecting the harbour's mouth from the swell occasioned by south-westerly winds, and serve to keep off the approach of shingle to the entrance. The expense, however, of these works cannot be stated without previous minute surveys, &c.

The harbour is managed by trustees.

Shoreham.

Shoreham, at the mouth of the river Adur, was the next harbour we visited.

The river, which formerly entered the sea nearly at right angles with the line of coast, has been gradually diverted from its original exit by the shingle, which constantly travels from the westward, and until a few years ago flowed along the shore in an easterly direction for three or four miles, before it at length found its way through the shingle bank into the sea.

This accumulation of shingle, consolidated by the alluvial deposit from the river, now forms an embankment between the river and the sea, varying from 200 to upwards of 300 yards in width; and an area of considerable extent is left within, into which the sea flows.

The entrance which existed at the eastern extremity of this estuary, once the river's mouth, has been blocked up, and an artificial channel has been cut through the shingle embankment about a mile from the town of Shoreham. This opening is preserved by wooden piers (formed of piles), 218 feet apart, which run in a south-south-west direction across the shingle into the sea. Within this entrance a third pier has been built out from the shore nearly across the harbour, for the purpose of directing the waters on the ebb, from the eastern and western sides of the inlet, directly to the mouth. The great body of water which thus ebbs and flows through the entrance serves to keep the channel open; and though the width is so considerable, the stream runs between the pier-heads at the rate of five or six miles an hour. The harbour's mouth is nevertheless subject to a bar, which rises occasionally above the low water level, and shifts its position from 60 to 160 feet from the pier-heads.

The lift of spring tides is about 15 feet, and neaps about nine feet. The depth of water over the bar at high water is from 14 to 17 feet, according to the tides and state of the bar.

From its proximity to Brighton, this harbour is of importance to the local trade. We were informed that upwards of a thousand vessels enter annually. It is capable of improvements; the most obvious of which are, the extension of the present piers and the filling in of their centres with rubble, which are now partly open, and admit the shingle into the entrance.

The interior of the harbour might, at the same time, be deepened and generally improved, but we do not consider it capable of being converted into a deep-water harbour for the purposes pointed out by their Lordships.

The harbour is the property of a joint-stock company, established by Act of Parliament.

Littlehampton.

Littlehampton, which is the next harbour on the coast, is formed by the channel of the river Arun, which is led in a southerly direction into the sea, between two piers, composed of piles, with an extension of dicker-work.

The depth of water in the entrance between the piers is two to three feet below the level of low water, but a bar extends outside the dicker-work, across the mouth, which rises about two feet above the general surface, and is left dry at low water.

The lift of average spring tides about 16 feet, and of neaps 11 feet.

The larger vessels which enter usually remain near the river's mouth, at Littlehampton; but a vessel of 13 feet draught, when she has passed the bar, can proceed to Arundel Bridge, a distance of six miles, the bottom continuing of an uniform level throughout that extent.

The tide flows nearly 25 miles up the river, but the backwater thereby afforded proves of little value, in consequence of the narrowness of the channel and the sluggishness of the stream. It is scarcely necessary to add, that the harbour is not available for the objects of our inquiry, and the shoalness of the water on this part of the coast renders the situation inapplicable for any national undertaking.

The harbour is under the management of trustees.

Pagham.

Pagham was the last place we examined; it consists of low ground of very considerable extent, over which the tide flows at high water, and is entered by a crooked channel which continues some distance inland; vessels of 40 tons and under, with coals or manure, are the only traders to the place.

There is no artificial harbour, and the situation is not deserving of attention.

General Remarks.

Having now completed our remarks on the state and capabilities of the existing harbours, &c., it is evident that there is no port at the present moment between Sheerness and Selsea Bill which can be considered an available harbour of refuge at all times of tide, or that possesses the capability of being rendered efficient for such a purpose, by any improvements or alterations which could be made.

We proceed, therefore, in conformity with their Lordships' instructions, to point out the situations which, in our opinion, are best calculated for stations for armed steam-vessels during war; and the works necessary to render them available for such a purpose, and at the same time to combine all the objects for which refuge harbours are so much required for the security of shipping navigating this part of the Channel.

We are decidedly of opinion that deep-water harbours on this part of the coast must be formed in the sea by means of breakwaters detached from the main land, on the same principle as that in Plymouth Sound, or connected with the shore by piers similar to the harbour at Kingstown, near Dublin.

The situation which appears to us to be of the greatest importance, and at the same time offers the most eligible position for a deep-water harbour, is Dover Bay. Independently of its proximity to the Continent, this bay possesses considerable advantages: the depth of water at 400 yards from the shore, is two fathoms at low water of spring tides, and but six fathoms at 1,100 yards; which therefore affords a sufficient width for the construction of a capacious deep-water harbour, without getting into such a depth for the site of the piers or breakwater as would add greatly to the expense of the works. The principal feature of the proposed plan is a breakwater, at the average distance of 1,000 yards from the shore, with piers projected from the land towards its eastern and western ends, leaving one or more entrances, as shown on the plan, Fig. 1, at A, B, and C.

These piers and breakwaters to consist of large blocks of the hardest chalk rock, with a thick covering of stone, either granite or hard limestone.

The space between the piers, or length of the harbour, as shown upon the plan, is 2,300 yards, and the area enclosed would comprise 450 acres,[*] of which 320 would have from six to two fathoms at low water, and 130 acres under two fathoms. The breakwater may be connected with the east and west piers, and have but one entrance in the middle (C), 600 or 700 feet in width; or it may be detached from the piers, so as to leave an entrance (A) nearly opposite the present harbour, and another opening (B) at the eastern end.

The advantages of two entrances, one at the eastern and the other at the western end, instead of one only in the centre, would be that vessels might enter or leave the harbour with the wind from any quarter, and a ready access be afforded to the mouth of the present harbour from the western entrance, without passing through the centre of the new harbour.

On the other hand, one entrance in the middle would have the advantage of rendering the interior of the harbour in some degree quieter than with two entrances.

On consideration of the subject, our opinion is in favour of the two entrances at the east and west ends; but the decision of the question need not delay or interfere with the execution of the work, as it might be proceeded with along its whole extent (with the exception of the entrances), and the result of the advantages, or otherwise, be tested by actual observation.

As a second place for a harbour of refuge, we recommend the bight to the eastward of Beachy Head and westward of Langley Point, and the formation there of a detached breakwater curved or in kants, the main body running nearly parallel with the shore, leaving entrances to the eastward and westward, to enable vessels to sail out or in with any wind (Fig. 2).

There is a sufficient depth of water near the shore, and but a small increase of depth for a considerable way out; affording a large harbour space, and facility for the formation of the necessary works. Looking at the locality as nearly equidistant from the South Foreland on the east, and the harbours and anchorages within the Isle of Wight on the west, and to its relative position with many harbours on the opposite shore; also to its proximity to the elevated promontory of Beachy Head; we think it offers important advantages, both as an asylum harbour and station for armed steam-vessels.

The breakwater, if built in five fathoms water, and one mile from the shore, would give a width of about half a mile, having in no part less than two fathoms depth at low water; the area of course depending on the length.

One and a half mile of breakwater, including the arms, would give shelter over 450 acres of surface.

The third and last situation we recommend for a harbour of refuge, is under the chalk cliffs to the eastward of Margate. The Chalk Bank and Longnose Spit stretch out to the north-east from Foreness Point: upon this site we propose a pier to commence at the shore, and to be extended 1,000 yards clear in a north-north-east direction; thence to turn west-north-west for a length of 2,000 yards; terminating in a round end, to form the northern head of the entrance. The western pier to be carried out from the shore in nearly a north-east direction, and be the same length as the east pier.

This would enclose a harbour of 460 acres, of which 352 acres would be not less than two fathoms, increasing to six fathoms, and 108 acres would be under two fathoms at low water.

The entrance opening in a north-westerly direction would receive the protection of Margate Sand, and an opening in a west-north-west bearing would also permit vessels to sail in with winds from the south round westward to north-east, and out with winds from the north round eastward and southward to south-west. And in extreme cases, when the harbour could not be entered by sailing vessels, shelter would be given them under, or to the eastward or westward of it.

The construction would be, as at Dover, a core of chalk blocks from the adjoining rocks, faced with stone.

The advantages of this situation will be apparent when it is remembered that our eastern coast is literally without shelter from easterly winds for vessels of any magnitude.

A harbour off Foreness must, therefore, be regarded as one of refuge for vessels stationed in the North Sea, and would more particularly have reference to every thing connected with the opposite ports eastward of Calais.

For the mercantile marine, especially, navigating the northern part of the English Channel, the situation would be most desirable; inasmuch as vessels bound to the westward from the river Thames or the North Sea, arriving off the North Foreland, and then finding the wind strong from the southward and westward, would, in order to avoid anchoring in the Downs, and the liability to accidents which so frequently occur there in south-westerly gales, gladly avail themselves of the shelter which this harbour would afford.

To vessels, also, caught in the Downs by tempestuous weather, or having received damage, a harbour off Foreness, accessible at all times of tide, would prove an invaluable asylum, where heavily-laden ships would escape the danger of grounding; and a considerable fleet of such vessels would lie in perfect security from storms or an enemy, until a change of wind would enable them to proceed down Channel.

Similar advantages would be experienced during easterly winds, by vessels from the westward, bound to ports upon the east coast; whilst to steam-vessels the harbour would be accessible in all winds and weather.

The cost of each of the three harbours of refuge we have recommended, may be taken as nearly equal; none of them less than £2,000,000 sterling, nor much exceeding that sum. An addition of a quarter of a mile to the length, would give an increased area of 100 acres, and would add about £300,000 to the estimated expense of each harbour.

We have not considered it necessary to enter into any details as to the defences which might be required to these places of refuge, but there can be no doubt of the practicability of rendering them secure.

The introduction of steam navigation will render a rapid communication along the coast an object of far greater importance than heretofore; and we consider that railways along the coast, on each side of Dover, may be made extremely useful in sending support in the shortest possible time to any point where the presence of troops may be required.

We have, &c.

(Signed) James A. Gordon, Rear-Admiral.
Alex. T. E. Vidal, Captain.
Robert Thomson, Lieut.-Col. R. E.
Richard Drew, Elder Brother of Trinity-house.
J. Walker, } Civil Engineers.
W. Cubitt,

30*th May* 1840.

---

[*] Kingston Harbour is 220 acres.

RAILWAY COMMUNICATION WITH SCOTLAND.

Second Report of Lieut.-Colonel Sir Frederic Smith, of the Royal Engineers, and Professor Barlow, to the Lords of the Treasury, in pursuance of the Addresses of the House of Commons, of the 14th and 20th August, 1839.

Railway Committee Office,
5, *Committee Room, House of Commons,*
May 16, 1840.

Sir—The instructions of the Lords Commissioners of the Treasury, communicated to us in your letter of the 26th November, 1839, having directed that we should examine and report upon the surveyed and projected lines for a railway communication between London and the cities of Edinburgh and Glasgow, in conformity with the address of the House of Commons, dated the 14th of August, 1839, we entered upon this inquiry immediately on receiving from the promoters of these lines the documents which had been prepared for the investigation.

The address to which we have referred prays "that her Majesty will be pleased to give directions that an engineer, or engineers, may be appointed to to inquire and report upon the relative merits, and the preference which ought to be given to the respective already surveyed and projected railways between London and the cities of Edinburgh and Glasgow, following, namely, viâ York, Newcastle-upon-Tyne, and Berwick; viâ York, Newcastle-upon-Tyne, and Hexham; viâ Lancaster, Whitehaven, and Carlisle; and viâ Lancaster, Penrith, and Carlisle; and said inquiry and report to include the relative merits of the two lines, from London to York, by Derby and Rotherham, and by Cambridge and Lincoln."

The investigation entrusted to us divides itself into two branches; the one being the relative merits of the competing lines between London and Edinburgh, and the other, of those projected between London and Glasgow.

Their lordships having granted an extension of time to the promoters of certain lines north of the Carlisle and Newcastle Railway, for the purpose of enabling these parties to render their surveys more complete, and some of the documents necessary for testing the relative merits of the proposed lines of communication from London to Newcastle not being ready for our examination, we have devoted our attention principally to the subject of the communication between London and Carlisle, and to the merits of the Cumberland railways, as regards their connexion with the western parts of Scotland, and the north of Ireland, to which our attention is called by the address of the House of Commons, dated the 20th August last, and we have now the honour to report the result of our inquiries.

It appears that by the London and Birmingham, the Grand Junction, and the North Union lines, the communication by railway is complete as far as Preston, being a distance of 218 miles 51 chains, and we find that the Preston and Lancaster Railway is in a state of great forwardness. When this last-mentioned line shall be finished, the distance by railway from London to Lancaster will be 238 miles 69 chains.*

Description of the competing Projects.—Three projects were laid before us for the extension of this great trunk line to Scotland.

One from Lancaster, along the west coast of Cumberland, through Whitehaven to Maryport, in order to join the railway now in progress between the latter place and Carlisle.

Another from Lancaster by Kirkby Lonsdale, and the valley of the Lune to Penrith, and from thence to Carlisle; and a third from Lancaster to Kendal, and thence up the valley of Long Sleddale, and by Hawes Water to Penrith, to form a junction with the proposed railway from the last-mentioned place to Carlisle.

West Cumberland Coast line.—The documents respecting the Cumberland coast line, delivered to us by the solicitors, Messrs. Haslam and Bischoff, and the engineers, Messrs. Rastrick and Hague, are copies of their parliamentary plan and section; drawings descriptive of the proposed mode of forming the embankments across Morecambe Bay, and the Dudden Sands, and a general plan of the country through which the line would pass. We were also furnished with a printed copy of a report on this project, by the engineers, and with a detailed estimate, formed by Mr. Hague, of the cost of the embankments.

The whole of the drawings illustrative of this project have been prepared in a very perfect and creditable manner, and have much facilitated our examination of the country.

Penrith and Carlisle line.—Mr. Larmer, the engineer, and Mr. Dixon, the secretary to the provisional committee of a Company for forming a railway from Carlisle to Penrith, supplied us with a section of this line, and a map of the county, on which the proposed route is traced.

Lune line.—We may here observe, that if this railway should be formed, it would be connected, at its southern terminus, with either of the inland lines that may be established from Lancaster. Mr. Larmer not only surveyed and projected the line from Carlisle to Penrith, but also that from Penrith to Kirkby Lonsdale. The line from the last-named place to Lancaster, we were informed, was laid down by persons under the direction of Mr. Locke, but the sections of the whole extent between Penrith and Lancaster, and tracing of it on maps of Cumberland, Westmoreland, and Lancaster were placed before us by Mr. Larmer, by whom we were also furnished with an estimate of the cost of the entire distance from Lancaster to Carlisle, and a report descriptive of this project.

Kendal line.—From Mr. Cornelius Nicholson, secretary to the provisional committee for the Kendal line, we received a section of this proposed railway, and a map of Westmoreland and a part of Lancashire, on which the direction of the line is traced. The survey, as well as a gross estimate of the cost of the line, were prepared by Mr. Bintley, of Kendal, by whom a report respecting it was drawn up, which will be found in the appendix.*

In the course of our examination of the documents submitted to us, we found that, with the exception of the drawings and report of the coast line, they were insufficient for the purpose of fairly testing the relative merits of the several projects now under consideration, and we therefore called for further information, not only as to their mechanical, but also as to their statistical properties. This information having been in part supplied on the 18th February, we commenced on that day an examination of the country through which these projected railways would pass, and we shall now give a general description of their principal features, beginning with the Cumberland coast line.

Cumberland Coast line.—It is proposed that this railway should commence at the terminus of the Lancaster and Preston Railway, and that, curving round towards Skirton, it should first cross the Kendal Canal, and then the River Lune; the latter on a bridge, the arching of which is represented by Mr. Rastrick to be 660 yards in length, and of the extreme height of 67 feet above the bed of the river. From Skirton the line is to proceed by Torrisholme to the village of Poulton; from hence it would be carried, in the direction of Leonard's Point, in the peninsula of Low Furness, on a lofty embankment of 10 miles and 51 chains in length, to be constructed across the estuary of Morecambe Bay, into which the Kent, the Crake, and the Leven empty themselves. Through the peninsula the railway would have to be formed in a line of double curvature, and in some deep cuttings in sandstone rock. It is also proposed to form an embankment across the Dudden Sands, from Ronhead Crag to Hodbarrow Point, a distance of one mile and 65 chains. These embankments are understood to be the suggestions of Mr. Hague, whose plan provides locks and flood-gates for the rivers, the channels of which he proposes to straighten and embank. It is here proper to state that the promoters of this line calculate upon reclaiming by the two embankments 52,000 acres of land, which they value at 23*l.* per acre, and they have therefore taken credit for £1,196,000 in the estimate of this part of their project.

From Hodbarrow the line would pass near Bootle to Ravenglass, through a country presenting no engineering work of difficulty or great expense until arriving at the River Esk, where a viaduct will be necessary of upwards of a quarter of a mile in length, and of 23 feet in the extreme height, approached by an embankment of about a mile in length, and of the average height of 15 feet.

The line is to curve at Ravenglass, passing the rivers Esk and Mite, and to take a direction towards the coast, crossing the river Calder at its mouth. It is also to be carried over the river Ehen, and thence to keep along the shore, requiring the occasional formation of embankments, between high and low water mark, to the valley of St. Bees. Here a curve is proposed towards the north-east to unite with one bending towards the north-west, which would bring the line, with tolerably easy work, to Whitehaven. It is proposed to carry the railway through the whole length of this town, on a series of arches, which Mr. Rastrick's section shows to be of the extreme height of 27 feet, and of the length of half a mile. On leaving Whitehaven a tunnel of 1,320 yards in length would have to be cut through sandstone. The line is from hence to pass towards Harrington, along the coast, through some short, but rather deep cuttings, and over four embankments, measuring altogether two miles in length, and of the respective heights of 18, 23, 27, and 34 feet.

Mr. Rastrick's plan is to cross the upper end of the harbour of Harrington by a bridge, which his section shows to be 120 yards long, and 27 feet high.

From hence the line is intended to take the direction of Workington, and to cross the harbour, as well as the Derwent river, on bridges and embankments.

From the Derwent to the terminus of the Maryport Railway, with which Mr. Rastrick's line is proposed to be joined, the work will be easy.

Expensive, or objectionable parts of the Cumberland Coast line.—The operations of an expensive, difficult, or objectionable character on the coast line, which we have thus briefly described, are as follows:—

1. The bridge over the river Lune.
2. The embankments across Morecambe Bay and the Dudden Sands, with the embankments to confine the courses of the rivers which empty themselves into these estuaries.
3. The cuttings in rock through Low Furness.
4. The viaducts and embankment across the rivers Esk and Mite, and over the sands at Ravenglass.

---

[*] If a line should be formed from Rugby to Stafford, or from Rugby to Stone, the distance would be shortened by about eight miles.

[*] We must observe, that the report omits to mention some of the expensive operations on this line, and but slightly notices other important works involved in Mr. Bintley's project; and we cannot help expressing our surprise that he should have stated that the proposed tunnel through the Gate Scarth, which the highest geological authorities represent to be composed of green slate and porphyry, could be formed at the rate of £50,000 per mile, a sum which is totally inadequate to cover the cost of so formidable an undertaking, particularly as the summit is nearly 1,200 feet above the tunnel.

5. The very extensive demolition of houses at Whitehaven, and the formation of viaduct of half a mile in length through that town.

6. The tunnel to the north of Whitehaven.

7. The crossing of Harrington Harbour, and the injury which would thereby be caused to that port, and

8. The crossing of Workington harbour, and the Derwent river.

To these may be added, the stoppage of the Ulverstone trade during the formation of the river channels, and a part of the Morecambe Bay embankment.

Although each of these operations would be attended with considerable expense, none of them presents what may be termed, great engineering difficulties, excepting the embankments of Morecambe Bay, and the Dudden Sands; but these are works of an extraordinary character and magnitude, and therefore require our particular notice.

Morecambe Bay Embankment.—The formation of an embankment of upwards of ten miles in length, across an estuary where the sea has been known to rise 30 feet, and where in gales from the north-west to the south-west, it rolls in with tremendous force, and with a rate of tide during the springs, of more than four knots an hour, may justly be termed a project of a gigantic character, and will, if executed, reflect much credit on the engineer.

The mode in which Mr. Hague would form the embankment is both novel and ingenious. (Vide *Journal*, Vol. I., p. 409).

The mode proposed for forming the embankment across the Dudden is the same as that for Morecambe Bay.

In Mr. Hague's report, (which will be found in the *Journal*, Vol. I. p. 410), he states that the total cost of forming the embankments and railway across Morecambe Bay and the Dudden Sands, would amount to £345,230 3*s.* 4*d.*, and of forming the new channels for the rivers which flow into these estuaries to £88,901 6*s.*, making a gross sum of £434,131 9*s.* 4*d.*

Not being satisfied with this statement, we called for a detailed estimate, which Mr. Hague accordingly prepared for us.

In this document the sum allowed for the embankments across the Bay is stated as £395,453 1*s.* 4*d.*, and for the river channels £71,758 0*s.* 7*d.*, making a general total of £467,211 1*s.* 11*d.*, which exceeds by £33,079 12*s.* 7*d.*, the sum specified in Mr. Hague's first report.

On a careful examination of these documents it appeared to us that a further detail was necessary, and we therefore requested additional information in respect to the alteration of the river channels.

From Mr. Hague's reply, which we received on the 23rd March, we find that he estimates the cost of raising the soil from the proposed river courses at only one-third of a penny per cubic yard; and of raising, depositing, and forming it into the embankments at 2*d.* per cubic yard. Conceiving this allowance to be inadequate to defray the cost of the work, we considered it proper to obtain the best information within our reach on this important item of expense; and, on application, we were supplied by the secretary* of the Trinity Board with a statement of the average cost of working the dredging engine used by them in the Thames. These are of the same power as the engines which Mr. Hague proposes to use; and it appears that, independently of the first outlay for the purchase of the vessel and machinery, the average expense of raising the mud from the river and shooting it into the barges, amounts to not less than 3*d.* per ton. Estimating the weight of a cubic yard to be 1 1-5th ton, the cost of removing the soil from the River Thames to the barges only, according to the above statement, amounts to 3 3-5ths of a penny per cubic yard.

We have also been in communication with the engineer † under whose direction the improvements in the River Dart have recently been made, and this gentleman has favoured us with a statement, from which it appears that the actual expenditure incurred in that work for dredging and depositing amounted to 4*d.* per ton, or nearly 5*d.* per cubic yard. We therefore feel warranted coming to the conclusion that Mr. Hague's allowance of 2*d.* per cubic yard, for dredging and depositing soil, in the formation of the river courses within his proposed embankment, is much too low, and that the smallest estimate that can be admitted for this work is 3½*d.* per cubic yard.

This increase of 1½*d.* per cubic yard would make the cost of the channels amount to £85,999 1*s.* 1*d.*; a sum which we are convinced would be found barely sufficient for the purpose, the more especially as there are other items in the estimate for the channels inserted at inadequate prices.

It is unnecessary for us, under all the circumstances of this inquiry, to go into any great detail of the result of our examination of the estimates of the embankment; but we must observe that an insufficient allowance has been made for the cost of some of the items, and especially in respect to the mass of stones proposed to be placed under the railway, in the centre of the embankment.

Mr. Hague allows £50,089 17*s.* 6*d.* for this item; but he has so much under-rated the quantity of stones that would be used, that without adding anything to the price which he has allowed for this material, and which we also think too low, we feel bound to add one-fourth to the above stated gross sum, increasing it to £62,612 6*s.* 10½*d.*

We should also observe, that in Mr. Hague's estimate of the embankments, he has not only inserted very low, and, on some occasions, inadequate prices for the proposed works, but he has also given the mere net quantities of materials and labour, allowing nothing for those contingencies which, in all great works, invariably arise. In an operation of the peculiar and difficult character now under consideration, contending, as the engineer would have to do, with the rapid tide we have described as pouring into the bay, contingencies beyond the ordinary proportion would be inevitable, and the least allowance that could prudently be made for them would be 10 per cent.

It is stated by Mr. Hague that the operations of the tide would supply 6,149,379 out of the 10,453,785 of cubic yards of sand and silt required for his embankments, and that when formed as proposed, they will be watertight, without having recourse to the expensive operation of puddling.

We do not believe that these expectations would be realized; but even admitting that this would be the case, the minimum cost of the embankment and channels, according to our opinion, would amount to £493,975 11*s.* 9½*d.*, and, with the addition of 10 per cent, for contingencies, the estimate should not be stated at less than £543,373 2*s.* 11¼*d.*, being £109,241 14*s.* 7½*d.* more than the sum specified in Mr. Hague's original report.

The projectors and promoters of the Morecambe Bay line appear, however, to entertain a confident expectation of effecting their object at a cost which would render the work highly advantageous in a pecuniary point of view, and, at the same time, most beneficial to this part of the country.

A very intelligent gentleman,* who is a land-owner at the upper part of the bay, has made several experiments, with various kinds of grain, to test the quality of the soil proposed to be enclosed; and based upon the results he has thus obtained, he gives it as his decided opinion that it will be highly productive.

It is now necessary to say a few words respecting the proposed operations at Whitehaven and Harrington.

Proposed operations at Whitehaven.—We annex two sketches, showing the line selected for the railway through those places. It will be seen, that the intention is to take down houses in Whitehaven to the extent of half a mile in length, and to construct the proposed viaduct on the sites which these buildings occupy. It is true that, for the most part, they are of little value; but, nevertheless, the compensation that would be claimed for them would, in all probability, be considerable; and, should they become the subject of litigation, the amount that would be awarded to the proprietors, and the law expences connected with this part of the work, would be found no inconsiderable items in the cost of the railway.

As we have already stated, it is intended to cross Harrington Harbour by a viaduct.

The crossing of the Harbour at Harrington.—The whole extent of the harbour is only 762 feet in length, and 220 in breadth; and, as it is used as well for a port of refuge as of lading, and there is an insufficiency of space for vessels to anchor and swing in, an artificial beach has been formed at the eastern or upper end, on which they are enabled to bring up.

The proposed viaduct would cut off about a third of the harbour. This would not only be objectionable on account of its diminishing the capacity of the port, but also by its depriving the shipping of the artificial beach to which we have just alluded. The objection to curtailing the size of the harbour will be apparent, when we state that the harbour-master supplied us with a return (verified by the custom-house officer), by which we find that, in the course of the last year, no fewer than 510 vessels used this port, and that, during gales of wind, it was frequently so full that they were in actual contact from side to side. After well considering this part of the subject, we are of opinion, that whatever expense or other inconvenience it might cause, it would be necessary to adopt some other mode of carrying the railway past Harrington than that proposed.

From the table of gradients it will be seen that the gradients of this line are very favourable.

EXAMINATION OF THE INLAND LINES.

Examination of the Line from Penrith to Carlisle.—We shall now describe the two inland lines, commencing with the proposed railway from Penrith to Carlisle, which is common to both projects.

In this line, which is about 17½ miles in length, no engineering difficulty presents itself.

It would pass through or near the following places: Calthwaite, Southwaite, Barrock, Wreay, Brisco, and Upperby, to form a junction with the Newcastle and Carlisle Railway at St. Nicholas.

The greatest embankment in this distance would be about two miles in length, and of an average height of about 16 feet, between Penrith and the Peteril stream.

At Southwaite, a cutting would be necessary of about three quarters of a mile in length, averaging 20 feet in depth, in sand and clay.

Near Wreay, a heavy cutting is proposed, in sand and gravel. Its length is about a mile, and its extreme depth 50 feet, the average being 30.

Examination of the Line of the Lune, from Lancaster to Penrith.—We shall proceed to point out the course of the lines which are proposed to form a junction with the Penrith Railway, and we shall begin with the project of the valley of the Lune, starting from Lancaster.

It is intended that the terminus should be that of the Lancaster and Preston Railway, and that the line should be carried in the direction of Kirkby Lonsdale; a few miles to the westward of Sedbergh; thence by Borrow Bridge and Orton, and through Crosby, Ravensworth, Newby, Melkenthorp, and Clifton, to Penrith.

Between Lancaster and Kirkby Lonsdale the prominent features of this line are, first, the crossing of the River Lune at the Crook, on a bridge of 60 feet in height, and consisting of three arches of 50 feet span; then short cuttings in gravel of 65 feet, and 50 feet in depth; and near Kirkby Lonsdale a cutting of a quarter of a mile in length, and of the extreme depth of 67 feet, in limestone.

---

* Jacob Herbert, Esq.

† Mr. William Kingston.

* Mr. James Stockdale, of Carke.

From this spot to nearly opposite to Sedburgh, the only engineering work requiring notice is the crossing of the Lune twice in the short distance of 15 chains.

At Borrow Bridge the Lune would have to be crossed on a bridge of about 48 feet in height, consisting of one arch of 60 feet span; and here an embankment of nearly half a mile in length, and of the mean height of 20 feet, would also be necessary. From hence to Orton the points deserving of remark are the formation at Tebay of an embankment of half a mile in length, and about 35 feet in height; and the crossing of the Lune on a bridge of 54 feet in height, and about 200 feet in length.

From Tebay the line rises at the rate of 1 in 132, for upwards of three miles to Orton Scar, the proposed summit, which is 650 feet above the Lancaster terminus.

In approaching this summit, where a tunnel of about 1 mile and 30 chains would be requisite, there would be a cutting in rock of rather more than a mile and a half in length, and averaging 48 feet in depth; the extreme depth being 84 feet. On the northern side of the tunnel, another cutting in the same material would occur, of about half a mile in length, averaging 36 feet, and of the extreme depth of 75 feet.

These two cuttings, and the tunnel, which are in red sand-stone and limestone, would be the heaviest and most expensive operations on this line.

The extreme height of the hill above the tunnel is shown in Mr. Larmer's section as being 322 feet, and this we have found to be correct, by a survey made under our directions, and to which we shall hereafter more particularly allude.

Between the northern end of the tunnel and Crosby Ravensworth, the railway would keep in the valley, in which Mr. Larmer proposes to cross a mountain stream two or three times; for this purpose bridges would be necessary; but we are of opinion that it would be better to change the course of the stream, and to form a proper embankment for the railway, to keep it clear of the water during floods.

At Crosby Ravensworth a bridge 44 feet high, and at Mauls Meaburn another, 50 feet high, would be necessary, over two streams; an embankment would likewise be required at the latter place. At Morland Bank there would be an embankment of half a mile in length, and of the extreme height of 55 feet.

Between Newby and Melkenthorp a cutting in limestone, of a mile in length, and of the extreme depth of 28 feet, would be requisite. At the last-named place the Leathe would have to be passed, on a bridge of 66 feet in height, with an arch of 50 feet span, approached by considerable embankments.

At Clifton there must be a cutting in sand, of about a quarter of a mile in length, and averaging 30 feet in depth.

Between Clifton and Penrith, the Rivers Lowther and Eamont would have to be crossed on bridges of 52 feet in height, and 200 yards in length.

Examination of the Kendal Line, from Lancaster to Penrith.—It remains for us to describe the Kendal line.

It is proposed that this line should form a junction with the Lancaster and Preston Railway, at about 2 miles 54 chains from the terminus at the former place; that it should pass in a tunnel under the town of Lancaster, and then by a stone bridge across the river Lune, near the ruins of the old bridge.

From this point it would pass the villages of Sline, Bolton, Carnforth, and Warton; and thence crossing the Rivers Betha and Viver and the canal, it would be carried to within about a mile of the town of Kendal.

The line would then be continued by a rather indirect course to the entrance of the valley of Long Sleddale, where it would cross the river Sprint. It is intended that it should be carried to the upper end of this valley, where a tunnel becomes necessary to pass through Gate Scarth. Issuing on the north side of the hill, the railway would open on the valley of Mardale-green, and after passing by another tunnel through Chapel Hill, be continued along the western side of the lake of Hawes Water, surrounded by scenery of the most beautiful and romantic character, as far as the village of Brampton. From hence it would run for several miles nearly parallel to the course of the River Lowther, as far as the village of Askham, where it would skirt the Park of Lowther Castle; it would then have to cross the River Eamont, and proceed direct to the proposed southern terminus of the Carlisle and Penrith Railway.

The chief details of this line are as follow:—

The length of the tunnel proposed to be formed under the town of Lancaster is 13 chains; the length of the bridge over the Lune is represented by Mr. Bintley to be 400 feet, and its height 26 feet. Near Hestbank a tunnel of eight chains in length is shown in Mr. Bintley's section, but it is believed that this may be avoided.

No severe work would occur until nearly opposite to Carnforth Lodge, where there would be a cutting of half a mile in length, averaging 20 feet in depth, followed by an embankment of about a mile and a quarter in length, and 20 feet in mean height, having, about mid-way, a bridge over the River Keer.

From hence towards Burton there would be two cuttings through alluvial soil and limestone; the average depth being about 30 feet, and the total length something more than a mile.

Between the towns of Burton and Kendal the rivers Betha and Viver, as well as the Lancaster and Kendal Canal, would have to be crossed on bridges, and a tunnel of 13 chains in length, and nearly half a mile of deep cutting in schistose rock, would be necessary.

From Kendal to the entrance of the proposed summit tunnel, Mr. Bintley's section shows the necessity of the following works; and although an inspection of the country led us to believe that the line might, in some few instances, be improved, we do not think that the alterations we suggested on the spot are of sufficient importance to be adverted to in this report.

There are two rock cuttings of the average depth of 30 feet, and measuring together seven eighths of a mile in length; then there is a viaduct of the extreme height of 125 feet, and 16 chains in length; and in the following order, a tunnel of 11 chains, another of 14½ chains, then a cutting of three quarters of a mile in length, and averaging 48 feet in height; a viaduct 114 feet in extreme height, and 9 chains long, a cutting a quarter of a mile in length, of the average depth of 30 feet; an embankment also of a quarter of a mile in length, and 45 feet in height; again a cutting of the same length, and 38 feet in depth, an embankment half a mile in length, and 40 feet in height, crossing the Sprint on a bridge; and, finally, another embankment of 25 chains in length, and 50 feet in height.

These cuttings are chiefly in schistose rock. The River Sprint, which runs through the valley of Long Sleddale, has a rather tortuous course; and, as it frequently crosses the line of the railway, some difficulties would necessarily arise in diverting the course of this river, as well as of the mountain streams which flow into it.

In connexion with the summit tunnel there is a cutting, the longitudinal section of which is nearly of a triangular form, being three quarters of a mile in length, and 63 feet in extreme depth.

The length of the tunnel is shown on the section prepared by Mr. Bintley as 2 miles and 20 chains, and as being 1200 feet under the summit of the hill through which it would have to be pierced. On issuing from the tunnel, on the north side of the hill, there would be a cutting of rather less than a quarter of a mile in length, and about 40 feet in depth, and then a short tunnel of 20 chains, through Chapel Hill. It is stated by Mr. Bintley, that these cuttings and tunnels would be in rock of the clay slate formation.

The Rev. A. Sedgwick, who has very minutely examined this district, represents it as being composed of green slate and porphyry, which he conceived to have been elevated by the protrusion of mountain granite and syenite.*

Beyond the short tunnel there would be an embankment of about a mile in length, and about 28 feet in height. From hence, passing by Brampton and Hilton, there is nothing of importance to notice until arriving at Askham, where a cutting would be requisite, in rock of the grawacke formation, of 1¼ mile in length, and averaging 25 feet in depth.

Between Askham and Penrith there is no work of consequence, excepting the bridge across the Eamont, which would require to be 85 feet in height, and 200 feet in length.

Operations of an expensive or difficult character on the Kendal Line.—The engineering difficulties, or works of a very expensive character on the Kendal line, are as follows:—

1st. The tunnel under the town of Lancaster.
2nd. The bridge over the Lune.
3rd. The works in the valley of Long Sleddale; and,
4th. The summit tunnel.

The tunnel under the town, although only 13 chains in length, would be expensive, and might give rise to some opposition on the part of the inhabitants.

It is proposed to build the bridge for the railway over the Lune at the point where the old bridge formerly stood, and where the river makes an elbow towards the southern shore. In order to diminish the cost of the work, by avoiding the necessity of using coffer-dams, Mr. Bintley proposes to construct the bridge on the shore, opposite to Lancaster, and afterwards to divert the course of the river, so that it may flow through the arches of the proposed bridge, and he would then fill up the present bed of the river, and form an embankment across it.

The operations in the valley of Long Sleddale would require to be managed with much care and dexterity, for owing to its narrowness, and the space required for the railway embankments, the present courses of the River Sprint, and of its tributary streams, would be much interrupted.

However, all these matters are of but little moment in comparison with the great work of this line, the summit tunnel.

Summit Tunnel on the Kendal Line.—We have before remarked that this tunnel is proposed to be 2¼ miles in length, and to be approached on the south through a cutting of three quarters of a mile in length, and on the north by a tunnel of one quarter of a mile in length, and a cutting of nearly the same extent, making a total length of nearly 3½ miles of very severe work.

Comparison of the Lines.—Having now described, in sufficient detail, the principal features, as far as regards construction, of the three competing lines, we shall proceed to consider their defects and advantages, in order to decide upon their relative merits.

In the two inland lines, which we shall first compare together, the most striking defects are, obviously, their summit tunnels. * *

---

* Trans. Geological Society, 2nd Series, vol. 4, p. 67.

Observations on the mechanical properties of the three competing Lines.—*Coast Line.*—Referring now to the mechanical properties of these lines, it appears that the length of railroad to be executed on the coast line, between the terminus of the Preston and Lancaster railway at Lancaster, and the Maryport railway, amounts to 66 miles 42 chains, and that the length of the Maryport and Carlisle Railway, which is now in progress, is 28 miles 3 chains, making the whole distance between Lancaster and Carlisle 94 miles 45 chains; the gradients being of a favourable description.

Lune Line.—By the inland line of the valley of the Lune, Orton, and Penrith, the whole distance between Lancaster and Carlisle is 68 miles 48 chains; but the gradients are less favourable than those of the coast line.

Kendal line.—By the other inland line viâ Kendal, the distance between the termini at Lancaster and Carlisle is only 64 miles 34 chains; but as this line enters Lancaster on a different level from the terminus of the Preston and Lancaster railway, it does not form a junction with that line till it has passed 2 miles 54 chains farther on, towards Preston; so that the whole length of new line to be executed on this route will amount to 67 miles 8 chains, the gradients being somewhat less favourable than on the line of the Lune.

In order to make a comparison of the mechanical advantages and disadvantages of these lines, we have reduced several gradients to equivalent horizontal distances.

The principle of this reduction may be briefly stated as follows.

Explanation of the term equivalent horizontal distance.—There is always an increased tractive power required to ascend a plane beyond that which is requisite on a level, and therefore (the engine being the same) a certain amount of additional time is required in the ascent. This additional time would allow the engine to pass over a certain extent of horizontal distance with the same load, and this increase of distance may be taken as a measure of the retarding effect of the ascending plane.

In descending the same plane, the tractive force and time requisite are less than on a horizontal plane, and this effect may therefore be indicated by a horizontal line shorter than the plane; but as there is always more time lost in ascending than is gained in descending any given plane, a loss is sustained on the aggregate, and this whole effect may be expressed by an increased length of line, greater or less according to the steepness of the plane and the amount of the load, and this increased line is what has been denominated the equivalent horizontal distance.[*]

This mode of reduction has been carefully applied to the several gradients on each of the three lines now under consideration. We find that the locomotive power requisite to work the coast line of 94 miles 54 chains, with a gross load of 50 tons, is equivalent to that which would work a horizontal line of 98 miles 34 chains; while the mean equivalent distance, for the inland line of the valley of the Lune, is 78 miles 1 chain; and for the Kendal line, between Lancaster and Carlisle, 75 miles 9 chains. As far, therefore, as regards the expense of locomotive power, the advantage is much in favour of either of the inland lines, as compared with the coast line, while all the other expenses are still more in their favour, these latter expenses being generally proportional to the actual distance, such as police, stations, water stations, road repairs, government taxes, &c.

In order to ascertain the effect that this increased locomotive expense would have on the general working expenses of the several lines, we have examined with great care and attention the official returns of the principal working railways, separating, as far as possible, the charges for locomotive power from the other charges; and although we have found considerable differences in the proportions, according to the prices of fuel and other circumstances; yet, upon the whole, it appears to be a fair average to assume the locomotive expenses as amounting to one-third (or about 33 per cent.) of the total working expenses of a line of railway of moderate traffic; and since the equivalent distance on the inland lines is about one-sixth greater than the actual distance, the additional locomotive charge due to the gradients will amount to about 1-18th, or six per cent. on the general expenses of the line; or estimating, as is usually done, the total expenses at half the income, to about three per cent. on the latter; which, if borne by the traveller, would have the effect of increasing his fare 4*d.*, on either the Kendal or Lune line, assuming the fare under ordinary circumstances at 2*d.* per mile. At this rate of charge, and making the addition of 4*d.* on the inland lines, the fare for the journey between Lancaster and Carlisle would be—

By the Coast line	15*s.*	9*d.*
By the Lune line	11	7
By the Kendal line........................	10	11

In respect of time; estimating the speed, including stoppages, at 22½ miles per hour on the equivalent distances on the three lines, we find it to amount—

By the Coast line to........................	4h.	22m.
By the Lune line	3	28
By the Kendal line	3	20

It appears therefore, notwithstanding the mechanical disadvantages of the gradients on the inland lines, as compared with those on the coast line, that the expense to the traveller, as well as the time of performing his journey, would be considerably greater on the latter line than on either of the former.

We have next examined the claims of the three lines as regards the amount of population, and present coach and mail traffic.

The amount of population per mile has been found by dividing the total population within 10 miles on each side of the respective lines by the number of miles, employing in each case the census of 1831, and the amount of coach traffic has been determined in the usual way, from returns supplied to us from the stamp office.

We thus find—	Population per mile.	Passengers per annum.
By the Coast line......................	1,923	8,040
By the Lune line	2,240	21,528
By the Kendal line	2,460	21,528

To bring these several results more immediately into one point of view, we have collected and arranged them as in the following table:—

Table showing the Relative Properties of the projected Lines between Lancaster and Carlisle.

Data.	Kendal Line.	Lune Line.	Coast Line.
	M. C.	M. C.	M. C.
Length of line already made, or in progress ..	—	—	28 3
Length of new line to be made	67 8	68 48	66 42
Length of line to be worked between Lancaster and Carlisle..............................	64 34[*]	68 48	94 45
Locomotive power requisite to work each line, expressed in equivalent horizontal distances	75 9	78 1	98 34
Expenses of journey, per passenger, at 2d. per mile of actual distance, including 4d. extra on the inland lines	s. d. 10 11	s. d. 11 7	s. d. 15 9
Time on each line between Lancaster and Carlisle, at 20 miles per hour, of equivalent distance......................................	H. M. 3 20	H. M. 3 28	H. M. 4 22
Population per mile in length, within a distance of ten miles of each line	2,460	2,240	1,923
Average number of passengers licensed to be carried per annum, by mails and stage-coaches, the whole distance	21,528[†]	21,528[†]	8,040

It will be clear from an inspection of this table, that it would cost each passenger between Lancaster and Carlisle about 4*s.* more on every journey by the coast route than by either of the inland lines, besides the loss of nearly one hour in time.

For these reasons, as far as regards the communication between England and Scotland, which is the great object of our inquiry, we consider it to be our duty to give the preference to one of the inland lines.

As regards the communication between London and Manchester, viâ Carlisle, with Glasgow, there can be no question, from what has been stated, that the preference ought to be given to one of the inland lines; but it must also be admitted, that the coast line would offer greater facilities for communicating with Belfast and the north of Ireland.

We have, however, to observe, that the harbour now forming at Fleetwood, which, by the Preston and Wyre Railway, will be put in communication with London, and the manufacturing districts of Lancashire, appears to us likely to form a good point of departure for the north of Ireland and west of Scotland.

But the great question for consideration is, whether every passenger between Lancaster and Glasgow shall be compelled to spend 4*s.* or 5*s.* and lose one hour each journey by being taken round by Maryport, or whether the Irish passenger shall incur the same increased expense, and about the same loss of time, by being taken round by Carlisle to Maryport, to embark in the Belfast steamer, supposing him to select this route in preference to that by the Preston and Wyre Railway to the Harbour of Fleetwood. Now, as such steamer can only be supposed to make one or two passages per week, while the trains between Lancaster and Carlisle would probably run several times per day, it would be exceedingly prejudicial to the general public interest that the whole of the Scotch traffic should be compelled to pass along the coast line. With regard to the statistical claims of the coast line, it appears from returns with which we have been furnished, of the assessed taxes along this line, as well as of the exports and imports of the several harbours, the steam-boat traffic, and population, that these, although considerable between Carlisle and Whitehaven, are not so for the remaining 54 miles, viz., between Whitehaven and Lancaster, so that when divided upon the whole distance, they are generally less per mile than on the inland lines.

Opinion as to the preference which should be given.—From a full and careful consideration of all the bearings of the case, we therefore feel it our duty to reject the coast line, so far as regards its being made a link in the chain of connexion between England and Scotland.

The next question is, the preference which ought to be given to one of the two projected inland lines.

Referring again to our table, it appears that the mechanical superiority, although inconsiderable, is with the Kendal line, its equivalent distance being 75 miles 9 chains, while that of the Lune line is 78 miles 1 chain.

---

[*] See appendix to Barlow's treatise on the strength of Iron, &c., and also part 3, vol. iii, of the Transactions of the Institute of Civil Engineers.

[*] The Kendal line passes the Lancaster station to a junction with the Preston and Lancaster, 2 miles 54 chains nearer to Preston than Lancaster, making the distance from Carlisle to Lancaster only 64 miles 34 chains.

[†] Each of these numbers include the whole present mail and stage traffic between Carlisle and Lancaster, viâ Penrith.

The statistical properties are nearly the same on both lines, with the exception that the Lune line would not take in its route the important and thriving town of Kendal. The advantages this town would derive from the near approach of a railway from the north would be considerable, particularly from the facility it would afford for obtaining coal, of which the consumption is there represented to be large; and reciprocally the railway would derive an increase of its revenue by its connexion with this town.

It was evident to us in the course of our inspection of the country, that the engineering difficulties of that part of Mr. Bintley's line which extends from Kendal to Mardale Green, would entitle the Lune line to a preference, and we therefore inquired whether it might not be practicable to connect the two lines together by adopting Mr. Bintley's route from Lancaster to Kendal, and Mr. Larner's from Penrith down to Borrow Bridge, and by finding a practicable line from the last named place to Kendal; but Mr. Larmer stated that such a line would be of too expensive a character to admit of this proposition being entertained. However, since our return to London, and indeed since this report has been drawn up, the provisional committee of the Kendal line have requested us to receive and report upon a survey, recently made by Mr. Larmer, to connect the lines of the Lune and Kent, nearly in the manner above described. Our instructions preclude us from acceding to this request, but we have no hesitation in saying, that if a line has been found which would afford the advantage of a direct railway communication to Kendal, without either materially increasing the cost of construction, or the length of the line between Lancaster and Carlisle, and which would be free from other defects, it might be more beneficial to the public than the Lune line. This, however, is a subject for future consideration, and in the meanweile, keeping in view the general tenor of our instructions, the main feature of which, in the present part of our inquiry, is that we should determine what, under all circumstances, would be the best means of establishing a railway communication between London and the city of Glasgow, having reference, also, to the interests of the manufacturing districts of Lancashire, the western parts of Scotland, and the north of Ireland, we feel bound, after a careful and deliberate review of the advantages and disadvantages of the three competing lines, to state that we give the preference to the line of the valley of the Lune and Penrith over the Kendal line, on account of the greater engineering difficulties on the latter; and that we also give the Lune line a preference over the coast line, in consequence of its shortening the time and diminishing the cost of travelling to the greater proportion of passengers who would require to avail themselves of railway communication north of Lancaster.

We have to remark that the line to which we have thus given a preference, will require a smaller capital than either of the other lines; for the cost of its construction will be less than that of either the Kendal or the coast line; and it must be borne in mind that as respects the last, although its promoters calculate upon a great return for their outlay, by the land to be reclaimed in Morecambe Bay, still the capital for the embankments must be raised in the first instance.

It may not be irrelevant to observe, that if the statement of Mr. Hague, as revised by us in a former part of this report, should be nearly accurate, viz., that the cost of forming water-tight embankments across Morecambe Bay and the Dudden Sands, with the works dependent thereon, would only amount to £543,372 2*s.* 11½*d.*, and if there should appear a probability of the land to be reclaimed realizing so large a sum as £1,196,000, this project might stand on its own merits, apart from any connexion with a railway.

In conclusion, we have only to state that in our inspection of the coast line, we were accompanied throughout the whole distance by Mr. Briscoe, an assistant to Mr. Rastrick, and in our examination of Morecambe Bay by Mr. Hague, the engineer, and by Mr. Yarker, the solicitor, besides other gentlemen interested in this project. Mr. Larmer pointed out the Lune line, and Mr. Bintley the Kendal line, and we were also accompanied by the secretary and several members of the Kendal committee, all of whom evinced every desire to facilitate our inquiry; but it is to be regretted that more time and means had not been at the disposal of the surveyors of the inland lines, to have enabled them to prepare their plans and other drawings in an equally perfect and satisfactory manner with those of the coast line.

We have, &c.,

FREDERIC SMITH, Lieut.-col. R. E.
PETER BARLOW, F. R. S.
HENRY AMSINCK, Lieut. R. N. Sec.

To Robert Gordon, Esq., M. P.

Hull and Selby Railway.—We are glad to be able to state that a deputation of the Directors of this Company went over the line from the passenger station at Hull to the junction with the Leeds and Selby Railway at Selby, on Saturday, May 30. The carriage was drawn by one of the engines made for the Company, by Messrs. Fenton, Murray, and Jackson, of Leeds. The line being laid upwards of one-half of its entire length upon longitudinal bearings of Riga timber, is particularly easy and smooth; the remaining portion of the line is laid upon cross sleepers, and the whole will be completed in a satisfactory manner. As a considerable portion of the second line is finished, and a great number of men are employed upon the remaining part, there is no doubt that both lines will be completed for opening to the public on the 1st July, the time proposed by the Directors. The buildings at the Hull terminus, and also those at the Selby terminus, are nearly finished, as are the various station-houses on the line, and the Directors have in the past week appointed the clerks and other officers of their establishments.—*Hull Observer.*

REPORT ON THE PLANS FOR PREVENTING ACCIDENTS ON BOARD STEAM VESSELS.

IN consequence of the accident of the "Earl Grey" steam boat in 1835, the Trustees of the river Clyde, with a laudable desire to avert similar accidents, very shortly after the disaster issued the following advertisement.

> "THE Parliamentary Trustees on the River Clyde hereby offer a premium of One Hundred Guineas to any person who shall, in the opinion of the Trustees, or of a Committee of their number, within one month of this date, essay or furnish the best practical mode of effectually preventing accidents, from the imperfect construction or use of the steam engine, or gearing of steam vessels, in their navigation upon navigable rivers, and of carrying the same into permanent effect or execution, independent of the control or discretion of the master or crew of the vessel.
>
> The Trustees have also placed at the disposal of a Committee of their number, One Hundred Pounds, to be distributed among such scientific or other persons as may be unsuccessful competitors for the above premium, but who may, nevertheless, suggest such improvements upon the plan of the successful competitors, as, in the opinion of the Committee, may be beneficially adopted or ingrafted upon the said plan."

In compliance with this advertisement there were no less than 65 designs of apparatus and essays sent in. For the purpose of guiding the judgment of the Committee, they determined upon referring the whole to parties fully competent to investigate the merits of each apparatus and essay, and selected the following gentlemen: Mr. Robert Napier, Mr. James Smith, and Mr. D. Mackain, who undertook the task referred to them.

In consequence of the advertisement not limiting the premium to the actual inventor, numerous schemes were sent in which were the inventions of others, and many in daily use in all parts of the world. For the purpose of assisting the referees in their examinations, they divided the several designs and essays into classes, and again subdivided the classes into sections, and after a careful examination the referees sent in their report to the Committee, accompanied with drawings of the apparatus submitted to them. As this report is of considerable length, it is not our intention to give the whole, but shall content ourselves by giving the most material parts of it, accompanied with engravings of the apparatus for which the premiums were allotted.

REPORT.

To the Trustees of the River Clyde, Glasgow, by Robert Napier, Esq., of Glasgow, James Smith, Esq., of Deanstone, and D. Mackain, Esq., of Glasgow.

In compliance with the request conveyed to us severally by Mr. Turner, we have carefully considered the various plans, models and essays, lodged in the Council Chambers, numbered from 1 to 65.

As the terms of the advertisement neither restrict the competitors to the production of plans of their own invention, nor preclude from competition any apparatus already in use, it involves the possibility of the Trustees awarding the premium to one person, for the invention of another; or to the exhibitor of apparatus, which, though in general use, may still be considered the best adapted to attain the end in view.

Though we mention this to show that, unintentionally, private wrong might be done, or that a reward might be paid for an exhibition of that with which every maker of steam engines is acquainted, yet the open nature of the competition may have had the effect of obtaining, and we doubt not it was the object of the Trustees to obtain, a general view of the opinions entertained by persons whose attention has been directed to the important subject of preventing dangerous accidents on board of steam vessels.

The competitors differ in opinion as to the causes by which explosion is produced, and in consequence, the apparatus they submit vary in their construction and proposed use, according to the idea which each entertains on this subject.

A number of the plans very closely resemble each other, differing only in unimportant details—this we consider to be the natural result of so many persons applying themselves to the attainment of one object. It is also remarkable, that a great number have adopted the common safety-valve, as the principal part of their several designs; which may be regarded as a tacit acknowledgment of its general efficiency and extreme simplicity.

From these causes we have found it convenient, in preparing our Report, to divide the plans into classes, according to the causes of explosion which they are designed to modify or prevent, and to form these classes into sections, according to the means by which these objects are expected to be attained.

FIRST CLASS.

The first class contains the designs submitted by the competitors who are of opinion, that explosion proceeds from a gradual accumulation of steam in the boiler, increasing in elastic force by the continued action of fire in the furnaces, until it exceeds the strength of the boiler.

This class is divided into eight sections.

First Section.—The first section embraces those designs by which the competitors propose to discharge a quantity of water into the furnace, or into the flues leading from them, whenever the force of the steam is sufficient to raise the water from the boiler to a certain height in a pipe, so that thereby the intensity of the fire may be diminished.

Second Section.—The principle on which the designs in this section are constructed, is, that when the pressure of the steam is sufficient to raise water from the boiler to a certain height, it rises round a hollow vessel or float, suspended at that height from one end of a lever, the other end being connected with a safety-valve of the common form. In some of the plans, the hollow vessel or float is designed to act as the load on the safety-valve, so that, to whatever extent it may be immersed in the water, so raised by the strength of the steam, to that extent is the safety-valve lightened of its load. In others, the weight of water displaced by the float, is a force, in addition to the steam, to raise a valve loaded in the ordinary way.

Third Section.—This section embraces the greatest number of plans, which contain, in general, the common safety-valve enclosed in a case, so as to prevent all access to it. The design of some of the plans is, however, worthy of attention, from their ingenious complexity.

Fourth Section.—These designs have the common safety-valve cased in, to prevent it from being overloaded, but have attachments to the valve, by which it can be opened by the engine-man whenever he finds it necessary to permit the steam to escape.

Fifth Section.—The distinguishing feature of the plans in this section, is the introduction of a piston in connexion with the safety-valve, with the design that the gradual increase in the force of the steam shall, by acting on the under side of the piston, become a proportionally increasing power to open the safety-valve.

Sixth Section.—The arrangement of the apparatus in this division is designed with the view of loading the safety-valve when the engine is at work, and of taking off the load when it is at rest.

Seventh Section.—In this section the exhibitors propose to substitute mercury for the loaded valve, which is usually employed to confine the steam until it has acquired a certain amount of force.

Eighth Section.—The competitors included in this section propose a connexion to be made between the throttle and safety-valves, by which, when the speed of the engine is required to be reduced, the safety-valve is opened, and the steam allowed to escape.

SECOND CLASS.

The second class of competitors are those who are of opinion that the explosion of boilers is the effect of the instantaneous production of steam, on the evolution and ignition of inflammable gases in the boiler, in consequence of a deficiency of water; by which the flues (or passages through the boilers for the flame from the furnaces) being uncovered, they become red hot, and on water being brought in contact with them, explosion is produced.

This class is divided into two sections.

First Section.—The first section proposes self-acting apparatus for feeding the boilers while the engine is in operation, so as to prevent the water from falling below a certain level.

Second Section.—The second section proposes means of giving information when the water shall have fallen below a certain point in the boiler, by means of a pipe open at both ends and approaching to within a short distance from the flues, so that, when the water shall have been sunk below this pipe, the steam will be allowed to escape.

THIRD CLASS.

The third class are those competitors who consider explosions to be the result of weakness in the boiler, and propose that they shall be frequently proved.

This class might be divided into two sections, viz., those who recommend that periodical attempts be made to explode the boilers with a great pressure of steam, and those who suggest that they shall be frequently proved by a forcing pump; but it is unnecessary to make this distinction.

We shall close this summary by stating that there are several ingenious designs which cannot be classed with any of those mentioned, nor with each other; and, consequently, for an explanation of the principles of their construction and intended mode of operating, it would be necessary to transcribe the several essays in which they are contained; but this we consider unnecessary, from their being nothing of sufficient merit in them to recommend them to the notice of the Trustees. It will be remarked that, almost all the competitors propose their several designs to be adopted only as additions to the existing means of preventing explosion; that they almost unanimously recommended the continued use of the existing safety-valve; that several recommend the frequent proof of boilers: while a few only propose the appointment of inspectors.

In recommending to your favourable consideration some of the designs, we beg to lay before you the circumstances which guided our selection.

The theory advanced in the Essay No. 1, of explosions proceeding from the formation of gas in the boiler, by the flues becoming red-hot, thereby decomposing the water, and then inflaming these gases, has been, in our opinion, most conclusively set aside by the eminent philosopher, Mons. Arago, in a memoir on the subject of the present report. "Some persons," he writes, "struck with the prodigious and instantaneous effects which often result from the explosion of boilers, are persuaded that steam alone is incapable of producing them, and they call to their aid some gases susceptible of explosion." On this he remarks, "Hydrogen alone, or mixed with vapour, cannot explode—a mixture in the suitable proportions of oxygen and hydrogen is susceptible of explosion; but how are these gases to be collected in the boiler? Hydrogen is the product of the oxidation of metal—from whence, therefore, proceeds the oxygen? Can it be from the air contained in the feed water? It is warm, which prevents it from containing much air. I shall add, in fine, that the oxygen of the air would combine itself much more readily with the incandescent sides of the boiler, than with hydrogen; and that the product of the decomposition of water would be—not hydrogen and oxygen, but hydrogen and azote,"—a non-explosion mixture. And further, in a Report by the Committee of the Franklin Institute, on the explosions of steam boilers, made at the request of the Treasury department of the United States, they state, as the result of direct experiment, that the gas obtained by injecting water into a red-hot boiler, was a "non-supporter of combustion, and non-combustible."

The other theory advanced by the Essayists Nos. 1, 4, 7, 8, 9, and 20, is, that if the flues become red hot, and water be poured into the boiler, a volume of steam, of dangerous elasticity, is instantaneously formed, to which the safety-valves cannot give vent with sufficient rapidity, and, in consequence, the boiler explodes. In regard to this supposed cause of explosion,—the American Commissioners succeeded in exploding an experimental boiler, by injecting water into it while not only the flues, but the top, bottom, and sides, were assiduously kept red hot. This was done to ascertain the greatest effect that could be produced by steam generated under such circumstances. Their other experiments prove that water does not evaporate so rapidly when brought in contact with red-hot iron, as when the iron has been cooled down to a much lower temperature, and at this reduced temperature iron does not contain any considerable quantity of heat. In all experiments made by them and others, *time* has been a necessary constituent in the circumstances which permit a certain volume of water to be evaporated, and *confinement* to give it force; and the opening of a safety-valve has always been found to diminish the pressure, and lower the temperature of the steam. We are inclined, under a peculiar and merely possible combination of circumstances, to view this as a cause of danger; but we have not been able to discover any authentic instances in which explosion has been clearly traced to it. The general practical result of the flues being allowed to get red hot, is, that the plates composing them crack on admission of water, and from the copious discharge of boiling water and steam which ensues, many serious accidents have happened to the engine-men and fire-men, through whose negligence they have been occasioned.

Notwithstanding of the above theories advanced by the competitors, and also of several others promulgated by persons of high standing in the scientific world, we cannot, after a careful comparison between their reasoning and our own experience, arrive at any other conclusion than—that the explosions of steam boilers proceed from a gradual accumulation of steam, which, being deprived of sufficient means of escape, is, by the continued action of the fire in the furnaces, raised to a dangerous, and often destructive degree of density; and we conceive that all danger can be avoided by the regular action of the common safety-valve, if properly constructed and made of *sufficient capacity*. It sometimes happens that these valves, from neglect, become fixed; and we are of opinion, that the apparatus designed by the Essayists Nos. 2 and 41, which are drawn as figures 1 and 2,* are well calculated to apply a force, in addition to the strength of the steam, to overcome this adherence; and they have the advantage of being so designed, that after the overplus of steam shall have escaped, the safety-valve is allowed to resume its useful position.

We have remarked, that the greater number of explosions of steam boilers have occurred at the instant of starting the engine. Without taking on ourselves to assign any reason for this, or our being able to trace the immediate circumstance which precedes, and may have caused the explosion, we are of opinion, that the risk of accident may be lessened by the weight on the safety-valve being diminished until the engine is in motion, and the steam flowing away by a regular current. We are not satisfied with the efficiency of the various plans which are designed to attain this object; but we recommend to your notice, for its novelty, the design in Essay No. 18.

We conceive it to be of importance, that the safety-valve should be secured from improper interference; but, at the same time, that it should be so connected with the ordinary occupation of the engine-man, as to be put into almost hourly use. This must lessen, if not entirely prevent, the chance of it becoming fixed to its seat. Of the designs submitted to us, we consider that the plans in the Essays 4, 38, 55, and 56, are best adapted for this object, though they have been found liable to the inconvenience of becoming fixed at the joints which are inside of the boiler. Figures 33, 36, 38, and 40, are, we believe, in use in several steam vessels on the Thames, the Clyde, and the Mersey, and No. 36 has been seen on board the French Government steamer, "Le Meteore."

A number of the competitors recommend that the safety-valve should be locked up, to prevent all access to it by the engine-man; but in this recommendation we do not concur,—for, if those in charge of the engine be prevented from ascertaining the condition of the safety-valve, no reliance can be placed on it as a mean of preventing accident.

---

* The figures 1 and 2 will be found in another part of the Journal.—Ed. C. and E. Journal.

We also feel ourselves opposed to the majority of the competitors as regards a feeling which they evince against engine-men as a body. In any large class of society, there are always to be found individuals, whose improper conduct no laws can restrain; and we are inclined to think that the number of engine-men who recklessly endanger their own lives and the property under their charge, are nearly in the same proportion to the mass of engine-men, as felons are to the mass of society, notwithstanding of the watchful superintendence of the immense army of the law.

In a matter of such importance to the public, and to the proprietors of steam engines, we cannot avoid expressing our regret, that in the cases of explosion which have occurred, there are no scientific reports of the appearance and state of the engines, valves, or boilers. If a regulation were adopted by the local authorities, requiring intimation of every case of accident, and obtaining thereafter, before any alteration had been made on the damaged boiler, machinery, or buildings, a detailed report of their situation and appearance, we are of opinion that more certainty would soon be given to the conjectural causes which produce such accidents; and that, in consequence, in the construction or management of steam engines, means would be adopted which would lessen the chance of their recurrence.

In regard to the appointment of inspectors, which some of the competitors recommend, we beg to express our doubts as to the expediency of this measure. They must either be armed with discretionary powers, to admit or reject any alteration in construction or management of the machinery—in which case the immense amount of capital invested in steam vessels at each port must be subjected to the individual caprice of the inspector—or it will be necessary, in order to furnish them with precise instructions, that the Act of Parliament by which they are appointed, shall regulate what are and what are not infallible securities against accidents of every kind.

When we compare the almost innumerable multitude of persons who have annually availed themselves of steam conveyance at sea and on railways, for many years past, with the number of accidents that have occurred, it is gratifying to us to consider, that, with our attention so closely turned to the subject as it has been for some time, we not only cannot trace any cause of alarm, but are able to express our conviction, that it is the safest means of transport that now exists.

In conclusion, we beg to report our opinion, that a combination of the plans we have recommended to your notice might be advantageous, provided the attachments by which they are connected with the safety-valve be such, as that by no derangement of the new apparatus, can the former be prevented from acting. But we can view them only in the light of experiments, which will require some time of watchful superintendence, to ascertain their mode of operating under various circumstances, and to detect and remedy errors in their construction.

Extract from Additional Report.

In compliance with this instruction, we have no hesitation in recommending to you the plans marked by the Committee Nos. 2 and 41, lodged by Mr. James B. Neilson and Mr. George Mills, both of Glasgow. It will be evident on inspection, that they are identical in design, and that the difference in their proposed construction is quite immaterial. (See Figs. 1 and 2.)

For the reasons stated in our General Report, we conceive them to be the best of the designs submitted to the Trustees for preventing explosion.

You are farther pleased to request, that we should name "the three persons who have brought forward, in your opinion, the three *next* best plans, so as to enable the Trustees to consider whether any portion of the additional sum of One Hundred Pounds, allocated by the trustees, is, in the circumstances, fairly and justly due to any of the competitors who may be unsuccessful in obtaining the principal premium of One Hundred Pounds."

From the extreme similarity in design and execution of the plans which appear to us entitle to rank in the second class, we are unable to reduce their number to less than four, viz., those numbered by the Committee 4, 38, 55, and 56. which were severally lodged—the three first by Messrs. Allan Clarke and David Thompson of Glasgow, and Mr. John Baird of Shotts; and the last, the joint production of Messrs. William Neilson and William Muir of Glasgow.

Mr. David Thompson states that his design has been in use at Messrs. Boulton & Watt's Engine Factory at Soho; and, as stated in the General Report, the others are precisely similar to apparatus in common use in vessels on the Thames, the Clyde, and the Mersey; and, through the politeness of the commander, there was exhibited to one of the reporters, on board of the French Government steam vessel, "Le Meteore," arrangements for working the safety-valves, which were similar in design and mode of operation to the plans in Nos. 38, 55, and 56.

As we are of opinion that the premiums offered by the Clyde Trustees were for apparatus presenting some novelty of construction. and possessing means of security beyond that which the existing safety-valves and connexions have been supposed to afford, we do not, under this impression, consider these gentlemen *entitled* to participation in the second premium; but leave this to the decision of the Trustees.

We have no other remarks to offer to your consideration on the residue of the plans.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

ROYAL SOCIETY.

March 12.—The Marquis of Northampton, President, in the Chair.

The following papers were read:—

"*On certain variations of the mean height of the Barometer, mean Temperature, and depth of Rain, connected with the Lunar Phases, in the cycle of years from* 1815 *to* 1823." By Luke Howard, Esq.

The table given in this paper contains the results of calculations relating to the objects specified in the title, cast into periods of six, seven, or eight days, so as to bring the day of the lunar phase belonging to it in the middle of the time. The observations were all made in the neighbourhood of London. It appears from them that in the period of the last quarter of the moon the barometer is highest, the temperature a little above the mean, and the depth of rain the smallest. In the period of the new moon, both the barometer and temperature are considerably depressed, and the rain increased in quantity. The influence of the first quarter shows itself by the further depression of the barometer; but the temperature rises almost to the point from which it had fallen, and the rain still increases, but not in an equal ratio. Lastly, the full moon again reduces the temperature, while the barometer attains its maximum mean height, and the quantity of rain is the greatest. Thus it appears, that during this lunar cycle, the approach of the last quarter is the signal for the clearing up of the air, and the return of sunshine.

"*On the theory of the Dark Bands formed in the Solar Spectrum, from partial interception by transparent plates.*" By the Rev. Baden Powell.

This paper contains the mathematical investigation of the phenomena of peculiar dark bands crossing the prismatic spectrum, when half the pupil of the eye, looking through the prism, is covered by a thin plate of any transparent substance, the edge being turned from the violet towards the red end of the spectrum; and which were first noticed by Mr. Fox Talbot, and were ascribed by Sir David Brewster to a new property of light, consisting of a peculiar kind of polarity. The author shows, that on the undulatory theory, in all cases, a difference of retardation between the two halves of each primary pencil throughout the spectrum, may give bands within certain limits; and that it affords a complete explanation of the phenomena in question.

March 19.—The Marquis of Northampton, President, in the Chair.

The following paper was read:—

"*Contributions to Terrestrial Magnetism.*" By Major E. Sabine.

An increased activity has recently been given to researches in terrestrial magnetism, with the definite object of obtaining correct maps of the magnetic phenomena, corresponding to the present epoch, over the whole surface of the globe. To aid these researches, and to facilitate the comparison of the general theory of M. Gauss with the facts of observation, maps have been constructed of the magnetical lines, both as computed by the theory, and as derived from observations already obtained. The theoretical and actual lines of the declination and intensity have thus been represented in maps recently published in Germany and England, as have also the lines of the inclination computed by theory; but the corresponding map or the latter element derived from observations is yet wanting. The object of the present communication is to supply this desideratum, as far as regards the portion of the globe contained between the parallels of 55° N. and 55° S., and the meridians of 20° E. and 80° W.; comprising the Atlantic ocean and the adjacent coasts of the continents on either side. The observations chiefly employed for this purpose are two series *made at sea*; one by Mr. Dunlop, of the Paramatta observatory, in a voyage from England to New South Wales, in 1831; the other by Lieut. Sulivan, of the Royal Navy, in a voyage from England to the Falkland Islands and back, in 1838 and 1839. The observation of the magnetic dip at sea, which was commonly practised by the distinguished navigators of the last century, was unfortunately not resumed when the interest in such researches was revived on the restoration of peace; but it is by such observations only that the lines of inclination can be independently traced over those large portions of the globe which are covered by the ocean. The difficulties which attend the observation, occasioned by the motion and the iron of the ship, require the adoption of several precautions, which it is particularly desirable at this time to make generally known. The series of Messrs. Dunlop and Sulivan are discussed in this view; and the value of results obtained under circumstances of due precaution is pointed out by their success. The position of the lines on the land portion of the map is derived from 120 determinations in various parts of Europe, Africa, and America, between the years 1834 and 1839, of which about the half are now first communicated. The series of Messrs. Dunlop and Sulivan contain also observations of the magnetic intensity made at sea; Mr. Dunlop's by the method of horizontal vibrations, and Lieut. Sulivan's by the instrument and method devised by Mr. Fox. The degree of precision which may be obtained by experiments thus conducted, is shown by the comparison of these observations with each other, and with the isodynamic lines previously derived from observations made on land. The first section of this paper concludes with discussions on the relative positions of the lines of least intensity and of no dip, and of the secular change which the latter line has undergone in the ten years preceding 1837. In the second section, the observations of Mr. Dunlop are combined with recent observations on the coasts of Australia, by

Captains Fitz Roy, Bethune, and Wickham, of the Royal Navy, to furnish a first approximation to the position and direction of the isodynamic lines over that portion of the Indian ocean which is comprised between the meridian of the Cape of Good Hope and New South Wales.

March 26.—The Marquis of Northampton, President, in the Chair.

This evening was occupied by the reading of a paper, entitled "*Researches in Electricity, 17th series: on the source of power in the Voltaic Pile.*" By Michael Faraday, Esq.

May 14.—Major Sabine, R.A., V.P., in the chair.

The following paper was read:—

Experimental Researches into the Strength of Pillars of Cast Iron, and other Materials. By Eaton Hodgkinson, Esq.

The author finds that in all long pillars of the same dimensions, the resistance to crushing by flexure is about three times greater when the ends of the pillars are flat, than when they are rounded. A long uniform cast-iron pillar, with its ends firmly fixed, whether by means of discs or otherwise, has the same power to resist breaking as a pillar of the same diameter, and half the length, with the ends rounded, or turned so that the force would pass through the axis. The strength of a pillar with one end round and the other flat, is the arithmetical mean between that of a pillar of the same dimensions with both ends round, and one with both ends flat. Some additional strength is given to a pillar by enlarging its diameter in the middle part. The author next investigated the strength of long cast-iron pillars with relation to their diameter and length. He concludes that the index of the power of the diameter, to which the strength is proportional, is 3·736. He then proceeds to determine, by a comparison of experimental results, the inverse power of the length to which the strength of the pillar is proportional. The highest value of this power is 1·914, the lowest, 1·537, the mean of all the comparisons, 1·7117. He thus deduces, first, approximate empirical formulæ for the breaking weight of solid pillars, and then proceeds to deduce more correct methods of determining their strength. Experiments on hollow pillars of cast-iron are then described, and formulæ representing the strength of such pillars are deduced from these experiments. After giving some results of experiments still in progress for determining the power of cast-iron pillars to resist long-continued pressure, the author proceeds to determine from his experiments the strength of pillars of wrought-iron and timber, as dependent on their dimensions. The conclusion for wrought iron is, that the strength varies inversely as the square of the pillar's length, and directly as the power 3·75 of its diameter, the latter being nearly identical with the result obtained for cast-iron; for timber, the strength varies nearly as the fourth power of the side of the square forming the section of the pillar. Experiments for determining the relation of the strength to the length in pillars of timber, were not instituted, as, from the great flexure of the material, it was considered that no very satisfactory conclusions on this point could be derived experimentally. In conclusion, the author gives the relative strengths of long pillars of cast-iron, wrought-iron, steel, and timber.

INSTITUTION OF CIVIL ENGINEERS.

Address of the President.

General Meeting, February 4, 1840.

This being our first Meeting since my re-election as your President, allow me to thank you for the honour conferred upon me, and to congratulate you on the choice you have made of the other Members of Council, and Officers, who will I am sure be desirous of justifying the good opinion you have formed of them, by as frequent an attendance at the Meetings and attention to the business of the Institution, as their avocations will permit. This will indeed be but a proper return for the proof of your confidence in us, and I trust that the list of attendances, if again called for at the end of the season, will prove my anticipations to have been correct; for notwithstanding the truth of the old saying, that "where there is a will, there is a way," it must sometimes happen, that the attendance of some of us becomes impossible, from absence at too great distance or other cogent cause; yet I hope I may answer for my colleagues as for myself, that it is our determination to show that we have the "*will.*" But, gentlemen, be it remembered on your part also, that there is a reciprocal duty to perform—that of attendance at our Meetings, to give them the importance which the Council Table being full will not give, if the seats around the room are not respectably occupied; and that blame may not attach where praise is due, the Council (following the precedent set them) have desired a list to be made and tabulated of the attendance at the Meetings of each Member, Graduate, and Associate.

I trust, however, that there will be presented to your attention during the session so much new and interesting matter as will rather ensure your attendance as a personal gratification than as a bare discharge of a duty; unless this should be the case, mine would be an ungracious task to require your constant attendance, but if we succeed in exciting your attention, you will then come unasked. This good can only be attained by numerous and useful communications, which are valuable in themselves and give rise to instructive discussions. The Council therefore require plans and papers from you with the view of ensuring your personal attendance; and I wish to enforce this especially upon the country Members, from whom we receive very few communications. Looking at the extent and rapid progression of public works in this country at present, the new facts that are constantly being developed, the number and influence of the Members of our Institution, there ought not to be any dearth of important and interesting communications. That we have had many such, and that the number of them is increasing, I admit, but still they ought to be much more numerous. My remarks at the last Meeting referred more particularly to Graduates and Associates as defaulters on this head, but I must include the *Members*, not only for what they could themselves do, but more for the exercise of the influence they possess over Graduates in directing their attention to particular objects or works on which they might furnish communications. Half the work is done "when the subject is *fixed* on"—I say this from experience, as would be proved by reference to the communications that have been made through my suggestions at works which I have visited, or by individuals over whom I may be supposed to have some influence. If gentlemen would bear in mind the wants of the Institution whenever they visit any public work, they would rarely leave it without having reaped some knowledge that would be worth communicating, and they may be assured that their labours would be duly appreciated.

I named at the last Meeting the subject of the Library—I stated that which many gentlemen were not aware of, the understanding amongst ourselves, that each Member of the Council should contribute annually some Book, Picture, Drawing, or other present for the Library—I stated also that the Secretary was preparing a list of such books as it is desirable we should possess. This list will be printed and circulated, and I wish the Institution to understand that the Council do not desire to monopolize the right of presenting books but trust that their example will be followed by every one belonging to the Institution. We have space now for a good Library, and for an Institution like ours nothing can be of greater importance. It is especially necessary that our Library should contain as many good books of reference as possible, and I beg to suggest to Members possessing such books, that in presenting ing them to the Institution they do not deprive themselves of the advantage of them, but will have the satisfaction of permitting others to participate with them.

The increasing business of the Institution appearing to the Council to require now the whole and undivided time and attention of one properly qualified gentlemen as Secretary, they thought it their duty to make this a condition previous to appointment; I am glad to say Mr. Manby has accepted the office on these conditions. Mr. Webster, with whose abilities and science we are all well acquainted, has been elected Honorary Secretary, and the more of his time he can give us, the more, I am sure, we shall all feel obliged.

The question of qualification for Honorary Members has already engaged the attention of the new Council, and we may think it right shortly to bring the subject before the Institution. As the Bye Laws now stand, the necessary qualification for a candidate for election as an Honorary Member is, that "he be eminent for *science* and *experience* in pursuits connected with the profession of a Civil Engineer, but not engaged in the practice of that profession in Great Britain or Ireland." Now this distinction is so very circumscribed, that few men can be found who come strictly within its limits, whether we refer to the present list of Honorary Members, or even to the most distinguished individuals in this country who hold the highest places in science or scientific institutions, such as the President of the Royal Society—the Marquis of Northampton,—the Chancellor of the University of London, Lord Burlington. (I cite these two noblemen, whose love of and devotion to science, and whose eminence in certain departments of it, has entitled them to the high places they fill, as persons whom it might be very desirable to connect with the Institution, should such be their wish, but neither of whom can, so far as I know, be strictly said to be "eminent for *science* and *experience* in pursuits connected with the profession of a Civil Engineer.") If it be thought desirable to extend the terms of qualification, the definition may be altered to include individuals distinguished for their patronage and promotion of the studies and works of Civil Engineering, or a class of Patrons might be formed of such men. The Council will give this matter their best consideration, and will, I am sure, in any recommendation they may make, be guided by their desire only to extend the reputation and importance of the Institution.

My old and valued friend, Mr. Turner, of Rook's Nest, Surrey (formerly the friend and partner of Huddart), having presented me with an excellent portrait of that eminent philosopher and mechanic, I have thought that I could not do better than offer it to the Institution, having previously had Mr. Turner's entire approval of my so doing. Those who have seen Huddart's Rope Machinery, which was I believe as much the creation of his own brain as ever machine was of any man's, will not dispute my claiming for him the first rank for eminence in Mechanics: as a Navigator and Hydrographer, he was inferior to none: I had the pleasure of knowing him, and have always thought, that if the Mechanical Philosophers and Engineers of our days were to be ranked in pairs, Huddart was the man to be placed by the side of Watt. I am glad therefore to be the instrument of putting the Institution in possession of the portrait of Huddart, by Wildman, after Hoppner; but this is not unmixed with a feeling of jealousy, arising from our Member Mr. Burges having discovered that Mr. Whitbread had, at his seat in Bedfordshire, a portrait of *Smeaton* (a soul-stirring name to Engineers), by Gainsborough; he has, through Mr. Whitbread's kindness and by the aid of Mr. Turner, placed the picture in the hands of Mr. Wildman, the talented painter of Huddart's portrait, and I can answer for Mr. Burges's kind intentions towards the Institution in the trouble he has so taken.

I have only farther to add, that the Council have come to the resolution of devoting the rooms on the ground floor to the use of the Members of the Institution, and have directed the periodical publications to be placed there. We hope this arrangement will be found generally convenient and agreeable, and we think it will be particularly so to our junior branches and Members from the country, as they may there enjoy all the advantages of a club, with the additional one of being surrounded by their friends.

We trust our Funds will always admit of this arrangement being gratuitous, as well as suffer us hereafter to add to it other means of attraction.

In another point of view it may be found useful, as a central point where gentlemen may make known their being at liberty to accept engagements, and the Engineer may find the assistance he is in need of.

ROYAL INSTITUTE OF BRITISH ARCHITECTS.

June 1.—Mr. Kay, V.P., in the Chair.

At the ordinary meeting of this society, several very valuable donations were announced, amongst which a volume of Inigo Jones's designs for the Whitehall Palace, being the original drawings by Flitcroft, for Kent's publication. The council have been for some time engaged in forming a collection of all matters relating to Jones and his works, and this present was therefore a most valuable boon. A long conversation was held on the means of constructing flues, so as to render the employment of climbing boys unnecessary, and a strong desire was shown on the part of the meeting to aid the efforts now being made by the society established for the purpose. Mr. Fowler took occasion to mention to the meeting that the *Société Libre des Beaux Arts*, of Paris, had recently awarded to Mr. G. Godwin, jun., a silver medal, in testimony of their approbation of his published works, and commented upon the liberal feeling the society had thus evinced. A similar compliment was paid to Mr. Donaldson, on the publication of his work on doorways.

A paper was read "*On the Section of the London Bed of Clay.*" By Charles Parker, Fellow.

The principal subject of this paper was a description of the strata passed through in boring two wells in the village of East Acton, which we cannot follow without reference to the diagrams and tables by which it was accompanied. The result was, a further confirmation of the established geological fact, that a stratum of sand extends under the clay, and bears upon a chalk basin containing an immense quantity of pure water, and a further disproval of a commonly received opinion, that when two wells are formed in immediate vicinity, of unequal depths, the water passes from the shallower to the deeper. The two wells in this instance were 300 yards apart. In one, the water was found at the depth of 333 feet, in the other, the spring extended to the depth of 403 feet. In both, the water rose to within 18 feet of the surface, and then gradually subsided to 23 feet.

A section was also given of the strata in the vicinity of Shadwell, and some particulars of a well bored to the depth of 411 feet in the Temple, which emitted an odour so disagreeable as to render the water useless. This odour (having been satisfactorily proved not to proceed from any contact with drains) was supposed to arise from the disengagement of sulphuretted hydrogen. After three months had been expended in trying, without any benefit, the suggestions of several eminent chemists for obviating this inconvenience, the well was abandoned as a failure; but another trial of the water being accidentally made a year afterwards, it was then found to be free from smell, and of a remarkably good quality. A comparison of the chemical analyses made at the different periods, failed to explain in any way the cause of this alteration. The paper concluded with some observations on the employment of iron cylinders in well sinking, and a comparison with a similar mode of proceeding by the ancients with cylinders of baked clay, illustrated by sections of a well at Silinunte, and another at Girgenti.

Mr. Godwin read some observations on the modern state of painting on glass. This paper will be found in another part of the Journal.

June 15.—Mr. Moore in the Chair.

A paper "*On Original Composition in Architecture, illustrated by the works of Sir John Vanbrugh,*" was read by James Thomson, Fellow. (This paper we shall give in full next month.)

Mr. Donaldson read "*A Memoir of the Life of Thomas Archer.*"

Thomas Archer, an English architect, who flourished during the early part of the eighteenth century. He was a pupil of Sir John Vanbrugh, who, being appointed surveyor-general for the new churches in London, which were to be built by the grant of Queen Anne, gave several of them to his pupils. The new church of St. John the Evangelist, in Westminster, fell to the lot of Archer, and was built in 1728. The plan consists of an oblong with rounded corners, having at the east and west ends deep recesses for the altar and vestry, and on the north and south sides, bold projecting enclosed porticoes, flanked on each side by a tower, making four in all, and which now have staircases, to afford access to the modern galleries. At first the interior was enriched by columns, and there were no galleries: so that the inside must have originally been extremely effective. In 1741, the interior and roof were consumed by fire, which left only the walls and columns standing. The church was then rebuilt, the columns being omitted; in 1758 galleries were added, and subsequently lengthened in 1826 by Mr. Inwood, architect. When this fine building was first completed, justice was not done to the originality and powers of the architect; and Horace Walpole, with some other critics of the day, unable to appreciate its beauties, reprobated its cumbrous aspect, and its four towers.

The outside consists of a bold Doric order, well proportioned and elegantly profiled; the columns are about three feet four inches in diameter, and stand upon a lofty pedestal or podium, eight feet high. The north and south porticos are hexastyle, each consisting of four outer pilasters and two central columns; the three centre intercolumniations being recessed, and the outer interpilastrations being solid, these latter serve as bases to the towers, which rise at each end of the tympana. The entablature is surmounted by a ballustrade, except over the porticos, where there are pediments broken through in the centre, for the width of three intercolumniations, to admit a kind of fantastic pedimental group, with a perforated niche. The four towers have square bases to the height of about eight feet above the springing of the pediments, and then assume a circular plan. At the angles there are isolated columns with circular pedestals and circular entablatures, projecting from the main body of the towers. Above the entablature there is a gradually receding roof of concave profile, surmounted by a pine apple. The east and west ends of the roof are enriched by grouped gables, flanked by large enriched scrolls or trusses in the Roman fashion.

The whole composition is impressive, and its boldness loses nothing by the graceful playfulness of the outline. There are some inaccuracies of detail, which a little more study of purer models might have corrected; but the whole is well worthy a distinguished place among the striking productions of the Vanbrugh school. The exterior being entirely faced with stone, its solid magnificence forms a striking contrast to the parsimonious meanness, which distinguishes the like buildings of the present day. In vol. iv. p. 70, of Dallaway's edition of Horace Walpole's Anecdotes of Painting, Hethrop, J. Phillip's church at Birmingham, a work of considerable merit, the quadrant porticoes at Chefden House, and a house at Roehampton, peculiar, but striking in its effect, given in the Vitruvius Britannicus, are mentioned as works of Archer. To him also is attributed the fanciful and attractive pavilion at the end of the piece of water which faces the centre of Wrest House, in Bedfordshire, the seat of the Earl de Grey. This pavilion is hexagonal in plan, with a porch at the entrance, and, with very little attention to effect, might be made a very graceful object, well worthy the splendid mansion which has been recently erected by the present noble possessor, from his own designs and under his own immediate direction, and in which his lordship has evinced a great feeling for art, sound discrimination, and a happy adaptation of the style chosen, which is that of the French château of the time of Louis XV.

Mr. Donaldson also read a brief memoir of the life of Chevalier Stefano Gasse, of Naples, an Honorary and Corresponding Member of the Institute.

THE ARCHITECTURAL SOCIETY.

W. Tite, Esq., President, in the Chair.

This society closed its session on the 2nd ult. with a conversazionè, which was attended by Earl de Grey, the President, and many of the Fellows of the Institute of British Architects, also by Mr. Walker, the President, and numerous members of the Institution of Civil Engineers, besides many members of other scientific societies. The business of the meeting commenced by Mr. Grellier, the Hon. Sec. reading the report of the Committee detailing the lectures and papers that had been delivered, and the prizes awarded to the student members, and expressing their warmest thanks and acknowledgment to their President, Mr. Tite, for the energy and zeal with which he has forwarded the interests of the society.

The President then proceeded to award the prizes to the successful candidates, after which he read a paper of considerable research and interest, "*On Exchanges,*" which we have the pleasure of giving in another part of the Journal.

NOTES OF THE MONTH.

The Dean and Chapter of Westminster, we are happy to announce, intend to have twelve of the windows in Westminster Abbey glazed with painted glass. We hope that they will be ordered at once of the artists, and not of dealers, by whom the artists will be screwed down. Painters and sculptors are not subjected to such a vexatious process, and we do not see why painters on glass should be deprived of a great portion of the reward of their exertions.—The authorities at the Temple are also engaged in the restoration of their ancient church.

In the National Gallery, a very fine painting, the Infant Jesus, by Murillo, has recently been placed.

The Thames Tunnel will soon make its appearance on the Middlesex side. The Company have commenced clearing the houses for the purpose of prosecuting their labours with energy.

Mr. Cottingham the architect, invited a numerous party to a conversazioné at his Museum of English Antiquities, in the Waterloo Bridge-road, on Thursday, the 25th ult. We, certainly, were never so much surprised on passing through the numerous rooms, to witness such an immense collection of specimens (about 31,000 we understand) of domestic and ecclesiastical architecture, painting, sculpture, and furniture; every architect, artist, and lover of antiquities should not fail visiting this Museum—next month we intend to give a description of it.

We understand that a National Mausoleum has been projected upon a most magnificent scale, to erect a sort of "Second Westminster Abbey," for the interment of the noble, opulent, and illustrious dead, and we have heard that the drawings are now ready, though we have not yet been fortunate enough to see them. We do not know who the author of the grand scheme is, but it is whispered that Barry is the chief architect, and a friend who has been favoured with a sight of the drawings, informs us that the design is noble, chaste, and beautiful, and a most perfect specimen of art. No doubt such a building is much wanted, seeing that a nich in the Abbey is not now to be had for either "love or money," or within its precincts, and hence the necessity of the intended National Mausoleum. We shall endeavour to obtain permission to reduce and engrave the drawings for our next number.

The experiment of the New Water Company which has been going on to test the quantity of water which can be procured and brought by its own gravity to London from near Watford, is now nearly completed. As far as it has gone it has been most successful. Copious springs have been tapped to the depth of 97 feet, and the well of 20 feet diameter when only 16 feet deep. required 30 men to be incessantly pumping from 4 a. m. to 8 p. m. daily, to enable the sinkers to proceed. Telford never made a happier hit than in pointing out this spot for the supply of London.

The Annual Meeting of the Council of the Government School of Design for distributing the prizes, took place on Friday, the 26th ult. We were much gratified on witnessing the great progress made by the students since the last yearly meeting, and the marked improvements that could be traced in those drawings that were made from models and plants. The school is in a very flourishing state, and there are not less than 100 pupils. Mr. Labouchere, the President of the Board of Trade, distributed the prizes. Among the company present we noticed Sir R. Inglis, Bart., M.P., Sir D. Norreys, Bart., M.P., Henry T. Hope, Esq., M.P., T. Wyse, Esq., M.P., Sir David Wilkie, and C. R. Cockerell, Esq., R.A., the latter gentleman read the report of the committee.

At Paris they are now employed in engraving on the bronze of the column of July, the names of the combatants who were killed during the revolution. These names are 504 in number, consisting of about 4000 letters, and placed in alphabetical order, letter A at the top. Each letter is 8 centim. (3¼ in.) high, and 3 millim. (⅛ in.) deep. A good specimen of *engraving on a large scale.* The artists have got as far as L. It it said that the elephant is to be cast at last, and erected at the Barriere du Trone, the decorations of which are to be finished; all this however is far from certain.—On the recommendation of the Commisioners for Preserving Historical Monuments, the Minister of the Interior has directed M. Viollet le Duc to prepare a plan for the restoration of the church of Vezelay (Yonne), and M. Questel plans for those of St. Giles (Gard), and Louillac (Lot), and for the cloister of Moissac (Tarn and Garonne).—The French naval authorities have directed experiments to be made at Brest on galvanized iron, and on gutters of zinc and of tin. The Commissioners appointed have already recommended the application of galvinized metal in several cases, in order to test its properties on a large scale. By police regulations the extent of the projections of plaster cornices is limited at Paris to 16 m. (6 in.)

REVIEWS.

Pictorial and Practical Illustrations of Windsor Castle, from original Drawings. By Messrs. Gandy and Baud. London: John Williams, 1840.

When Achilles died, Ajax and Ulysses contended for his arms, dire was the conflict, and great the perplexity of the Greeks in coming to a decision, they ended it, however, if we recollect aright, by making the award in favour of one of the competitors, not as we should propose to do by giving a bit to one, and a bit to another, or forcing them both to squeeze themselves into the same coat of mail. Since Sir Jeffry Wyatville's death, a similar contest has taken place, equally distressing as regards the parties engaged, and the difficulty of coming to a safe decision. Sir Jeffry anxious for his fame, and for the proper illustration of his great work, Windsor Castle, during his life time employed two of his pupils, Messrs. Gandy and Baud, and expended large sums on the preparations of the necessary drawings. His death left the enterprise unaccomplished, and by his will he directed his executor to provide for the completion of a task, dear to him even in death. Messrs. Gandy and Baud, artists of approved competence, who had been employed by Sir Jeffry himself in carrying out the works, had engaged to make the necessary drawings on condition that they should be the persons solely employed in carrying out a work, the importance of which they fully appreciated, and in which they also took an interest, as having their own reputation connected with it. From some cause, however, which has not been explained, a dissension has taken place between the executors and the artists, and each party has determined on producing a separate work. This step in such a case cannot but be deeply regretted, for neither the public nor the publishers can be benefitted by a contest of this kind, the latter must have a diminished sale, and the former a deteriorated work, instead of both parties making a profitable union, and devoting their whole capital and energies to the production of one magnificent volume.

The specimens we have seen of both the contending works are creditable and well executed, but we do hope that there is still time to conclude amicably a contest so distressing. The executors have the fame of Sir Jeffry in their keeping, and Messrs. Gandy and Baud, architects themselves, cannot be unmindful of the reputation of their former master, or of their own; the public are not so selfish as to wish for an injurious competition.

The illustrations of the Part before us consist, of a beautiful lithographic drawing of the North West View of the Winchester Tower, drawn by Mr. Gandy; of the North East View of the Prince of Wales and Brunswick Towers, drawn by Mr. Baud, and lithographed by Hawkins; and two engravings in outline exhibiting details.

A Treatise on Projection, with numerous Plates. By Peter Nicholson. London: Richard Groombridge. 1840.

Mr. Nicholson has laboured hard for the profession, but although far advanced in years, he is still as fresh as ever in supplying the wants of the professional student; to this class the volume before us will be of great service. We will give an extract from the preface, which in the author's own words best describes the utility of the work.

> The theory of projection is of universal application; a knowledge of this useful branch of delineation will enable the designer to instruct the workman with nearly as much ease as if he had the model before him, and to explain the effect of an imaginary object as if it really existed; this knowledge in the workman will enable him to forsee how the different parts of an object will join upon each other, to understand drawings and designs with readiness, and to execute them with accuracy.
>
> Among many other uses to which this truly admirable science extends its influence, may be mentioned the construction of the centerings of arches and groin vaults, the formation of hand-rails and stairs, the cutting of stones for bridges and oblique arches, and the delineation of plans, and elevations of buildings and machinery. But the utility of an intimate acquaintance with the principles of this useful art is not confined to the workshop alone, a certain knowledge of these principles should form a part of that stock of information which is essential to the student in the arts of design, and the rapid strides which have of late been made in other departments of the arts and sciences render it far from improbable that we shall shortly see the theory and practice of projection taught in our public schools, as a necessary branch of education.

Treatise on the Theory and Practice of Naval Architecture. By Augustin B. Crewse, Member of the late School of Naval Architecture, &c. Edinburgh: Black. 1840.

We regret that the space occupied by other matter prevents us from giving the remarks which we had prepared on Mr. Crewse's work. This is a reprint of the article Ship Building in the Encyclopedia Britannica, and gives in a short compass the elements of the history and theory of the art, and also a great deal of information upon construction. We recommend the work to the immediate notice of our readers, as we must ourselves defer the consideration of it until next month.

Chemistry of Science and Art, or Elements of Chemistry, adapted for reading, along with a Course of Lectures, for self instruction, &c. By Hugo Reid. Edinburgh: Maclachlan and Stewart. 1840.

Mr. Reid's work is what it professes to be, a portable compendium of the principles of chemistry, not aiming at the extent and research of large works, but eschewing the superficiality of what are called cheap works. It is sound, cheap, and useful, eminently calculated for the artisan and the student, deriving its information from the highest sources, and giving all the improvements of the latest date. We have only one thing to quarrel with Mr. Reid about—and he has treated upon the subject so clearly, that we are half inclined to let it alone—and that is, that he has in the beginning of his work enlarged upon two or three subjects, which might better become the subject of his forthcoming treatise on the classication of the sciences.

LITERARY NOTICES.

Mr. Rooke has brought out a new edition of his Geology as a Science applied to Engineering, in which he has detailed some of the results of his last year's tour in France.

Dr. Day will not think us inattentive to his pamphlet on the Doctrine of Parallels, in deferring our remarks upon it until next month, as it requires a serious perusal.

SIR,

THE great leading objects of this national undertaking are, to provide a
Royal Service—to erect a species of *Insurance in Life* against A
unparalleled in any other Country, to our Commercial Mariners, not to
other States, where no such provision is, or can be made for Britis
habits of prudence in those who hitherto have been proverbially impr
those earnings, (generally sacrificed to intemperance or to trickery,) a
an adequate Income to enjoy each; and the whole conferred, not as a
at once "The Seaman's Refuge and Right."

All these things are of easy accomplishment. The Sailor, shoul
quota of the Insurance, may calculate on receiving at least ten times
accumulations of Compound Interest; partly by the deaths of those wh
Subscriptions of Owners and Merchants; partly by the Contributions
are ardently disposed to assist this Institution; and, generally, from th

In addition to these sources of Income and objects of utility, it is
time protect the Mercantile Seaman from those whom he most emph
uniting the benefits of a Saving Bank and a Loan Institution to the ot

It is proposed that a large proportion of the original Capital shall
some site near the Thames; and that the whole of the proprietary Cap
sale of terminable annuities for sixty years, at seven per cent. per ann
above par, by the Trustees of the Institution, at their option; and whe
entire property to belong to British Mercantile Mariners, and their succ

It will be necessary in the construction of the Building to divide
superintendence of the ablest and the best practical men, all disorder wi
will be preserved to meet the views as well as to conduce to the comfor

those
ence
unds
ve a
rship
r be
VIDED
rt of
ns in
thout
Board
oving
g the
efits,

SAFETY VALVES.

The annexed engravings are referred to in the Report on the plans or preventing accidents on board Steam-vessels, at page 246.

Fig. 1.

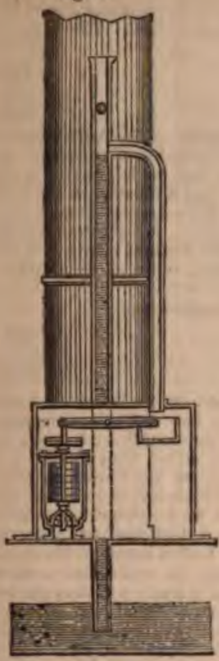
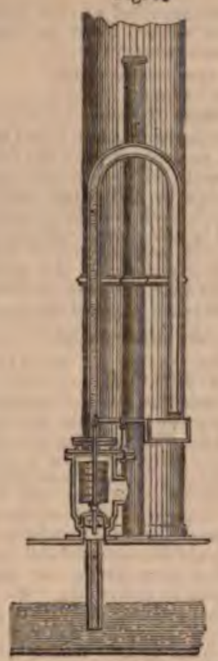


Fig. 2.



ON SUSPENSION BRIDGES.

Sir—I observe in your Journal of the past month, an engraving and cription of "Dredge's Patent Suspension Bridge," you will find at ge 23, vol. 1 of the Journal, an engraving and description of my dge, which was presented to the British Association for Science at weastle, in 1838. Mr. Dredge's bridge was presented to the Association last year at Birmingham. The identity of principle in the two dges is evident, and if it were desired to convert my construction that proposed by Mr. Dredge, it would be merely necessary to te each radial link with the one next it, but this would necessarily ert the rods from the diagonal line, representing the resultant of two forces, tending to destroy the bridge, which would be a very kilful arrangement, and attended with no practical benefit. I am desirous to enter into a controversy upon this matter, but I think I y claim from you the small justice, of allowing me to state in your t number, my claims to be considered the author of this system of structing suspension bridges; it may not be amiss to observe that arrangement is much easier of construction than either that of Mr. edge, or the ordinary suspension bridge, and would be cheaper and fer than either.

I remain, your obedient servant,
W. J. Curtis.

15, *Stamford Street, Blackfriars Road,*
June 17, 1840.

WYRE LIGHTHOUSE.

In our last number we gave an engraving and description of the Wyre ghthouse, together with the Specification, with the signature of "Henry ngles Denham," at the end, by which it may appear that the design and cification was that of Captain Denham, instead of which it will appear by following letter to have been entirely the production of Messrs. Mitchell Son.!

TO THE EDITOR OF THE PRESTON PILOT.

60, Pall Mall, London, May 9th, 1840.

r—It is right that the public should clearly understand that the specifion of the Wyre Lighthouse was the production of Messrs. Alexander chell and Son, and only signed by me to show I had considered, approved, caused its adoption. Your inserting this note in your next paper will ob- your humble servant,

H. M. Denham,
Consulting Marine Surveyor.

THE PROJECTED MERCHANT SEAMAN'S INSTITUTION.

(See Plate.)

The grandeur and great public importance of a project, the particulars of which accompany our Journal this month, will, we trust, excuse our departing somewhat from our usual course, in criticising a work at present to a certain extent undetermined, but which we prophecy will at no distant period be equally the pride and protection of the vast and deserving class for whose benefit it is especially intended, as a glorious and lasting monument of the national estimation in which they are so justly held.

The style selected, Palladian, so eminently suitable to buildings of large extent and intricate internal arrangement, and the boldness and simplicity of the ensemble, evince considerable judgment and taste in the artist, whose name however does not appear.

The plan is quadrangular, the entire length of the façade, we are informed, about 700 feet. The lower story consists of an arched and rusticated basement, supporting and subservient to the principal design which is of the Corinthian order; the entablature continued throughout and unbroken by those unnecessary and unmeaning projections which so frequently disfigure the best compositions; the central feature of the design is an octastyle portico of magnificent dimensions, upwards of 100 feet in extent, supported by an open loggia communicating with an arcade surrounding the quadrangle, and surmounted by a dome novel in design, but in harmony with the general character of the composition. Such are the leading features of the exterior;—of the interior we can give no opinion, the very excellent method having, we understand, been adopted of arranging it with reference to the opinion and advice of those who are practically acquainted with the purpose to which it will be devoted. We shall, however, keep a strict watch over its progress, and trust no petty interests or party feelings will interfere with the completion of so useful, so creditable, and so magnificent an undertaking.

STEAM NAVIGATION.

"THE RUBY" CHALLENGE.

Sir—The letter which appeared in the last number (for June) of your valuable Journal, signed by "A. Billings, Manager of the Diamond Steam Packet Company," has excited considerable stir amongst steam-boat parties. I do not, however, observe in that letter the public challenge[*] which the "Ruby" gave in the Nautical Magazine for this month, and in the latter periodical Mr. Billings, as "Manager of the Diamond Steam Packet Company," says, "I am *ready* to match the Ruby to run from Gravesend to Margate and back for 200 guineas against *any* boat afloat, whatever may be her size, power, or build."

Now your numerous readers may like to know if and how the match came off, and I beg a space in your columns to state the matter fairly.

I accepted the challenge through Mr. Roney, the Manager of the Polytechnic Institution immediately, and submitted that the conditions should be—to engage to run on a certain day, three weeks notice to be given.

To deposit 200 guineas each. The course to be from Gravesend round a boat moored off Margate wood pier. Time of starting to be named at once, and to take all chances of weather.

Sails to be used or not as the challenger pleased. Here I will only observe that as I should have to get the "Fire King" round from the Clyde, a distance of 850 miles, I stipulated for the above conditions as to time, believing the "Ruby" to be "READY." On the 13th Mr. Roney received answer from Mr. Billings, (but not signed by him as Manager of the Diamond Company), asking the "name of the boat, her tonnage and power, and the time she has been running, *when (i. e.* Mr. B.*)* shall be willing to enter upon the terms of the match."

Having read so much of his answer, and finding that his former words "*any boat afloat*," and his being "*ready*," were now appearing in a new light, I was amused to find the following philanthropic evasion thrust in, "provided that your vessel is worked by low pressure steam, as I feel convinced that the Diamond Steam Packet Company would not on any account whatever endanger the lives of their fellow creatures, by permitting their boat to enter into a contest with any vessel propelled by so hazardous an agent as high pressure steam!" and his letter concluded, "I shall be obliged by an answer to the foregoing before entering on the details of the match."

I protest that my regard for the lives of my fellow creatures is just as great as that of Mr. Billings and his Company—and I do consider that part of the letter mawkish in the extreme.

But the Ruby was not to get off the match quite so easily. I answered in the following words: that "I accepted the published challenge on the part of the owner of the 'Fire King,' of 663 tons, and with 57½ inch cylinders low pressure. She is private property and on no station for passengers; she has been afloat to *my* knowledge seven months,[†] but that has nothing to do with *your* challenge, further than that the 'Fire King' comes within the words used by you, 'any boat afloat, whatever may be her size, power, or build.'" Again I pressed him to conclude the terms of the match, and signed myself as agent for Robert Napier, of Glasgow, who owns the Fire King.

---

[*] We purposely omitted the paragraph, as we did not wish the Journal to be made the medium of betting.—Ed. C. E. and A. Journal.

[†] She has been afloat much longer.

Again I found the Ruby at fault, for Mr. Billings replied on the 15th June, that as the "Fire King" is low pressure, there could be no objection to make the match, *but* that his challenge was published when the Ruby was "lying up in dock, "at the present time the season is at its heat, and all the boats of the Diamond Company are in full employment, and the Ruby could not be spared off her station just now, she being their principal boat, you must therefore let the match stand over until the end of the season, when the Ruby could be withdrawn from her station for a few days for the purpose, if (mark the saving word 'if') the conditions are agreed to."

To this I answered on the 16th June, "your favour of the 15th has, I must say, surprised me. In this month's "Nautical Magazine you published your challenge, wherein you had to repeat 'that you were *ready* to match the Ruby to run from Gravesend to Margate and back for 200 guineas, against any boat afloat, whatever may be her size, power, or build." This was published on the 1st of this month. Mr. Robert Napier, the owner of the Fire King, met with your challenge some days afterwards in Glasgow, and although much disinclined to race, he could not allow it to pass unheeded, or your ship to be published as faster than the Fire King. He lost no time in instructing me, and on the 9th instant your challenge was accepted in London. You publicly stated that the Ruby was "*ready*," both last month and this month, after your season had commenced, but now when you have learned that the Fire King accepts your challenge, you object to run until after your "season" has finished.—I therefore now call upon you, and those concerned with you, to complete the match, as you are bound in honour to do within a reasonable time."

"Requesting the favour of an immediate answer, I am Sir, your's, &c."

My next and last letter from Mr. Billings "begs me to recollect that the Ruby is the property of a Public Company, whose engagements being completed for the season, they will not permit the boat to be withdrawn at present from the station."—So that the grand challenge ends thus in nothing; and I am confident your readers will conclude with me, that the Ruby shuns the trial altogether, and many of your readers will think as I do, that the Gasconade challenge was given in Mr. Billing's letter (which by-the-bye condemns "swaggering and boasting") merely to puff the Ruby or her engineers, in the vain confidence that no one would accept it. I beg to assure you I intend nothing disrespectful to Mr. Billings or his Company, or to those behind the scenes; it is a pity they should thus have tarnished the lustre of the Ruby.

I have now only to conclude by giving to you the "Fire King's" rate of steaming, as ascertained on the Gare-loch last October, in presence of Mr. John Wood the well known ship-builder, Mr. Lloyd the assistant-surveyor of steam machinery of the Navy, Mr. J. Scott Russell, Mr. Robert Napier, and myself.

	min.	sec.		miles
No. 1 measured mile	4	9	=	14·45 per hour.
2 ..	3	43	=	16·14
3 ..	3	58	=	15·13
4 ..	4	13	=	14·22
5 ..	4	5	=	14·69
6 ..	3	42		16·21
7 ..	3	57	=	15·19
8 ..	4	16	=	14·06
				8) 120·09
Land miles on the average per hour.				15·01

The miles were measured by us in three different and distinct parties, and the times taken by each individually. The Fire King's measurements are as follows:—

	feet.	in.
Length over stem and stern posts aloft....	180	5
Length of keel and fore rake	175	5
Breadth between paddles	28	0½
Depth in engine-room	16	8½

Making in all 663 tons O. M.

I am, Sir, your most obedient servant,

ALEXANDER GORDON,
Agent for Robert Napier of Glasgow.

22, *Fludyer-street, Westminster,*
June 23, 1840.

LAUNCH OF TWO IRON STEAM-SHIPS AT LIVERPOOL.

The confidence entertained in the good properties of iron vessels, and particularly their advantage in combining strength with that light draught of water requisite in some branches of trade, in peculiar localities, is becoming daily more and more confirmed, by the success, both at home and abroad, of the ships built of that material, and the improvements in their construction which experience enables the builders to introduce. It is not, therefore, improbable, but in twenty years hence, or perhaps within a shorter period, one half of our mercantile marine may be of iron, copper, or some composition of various metals that may be wrought by hammer, or cast in pieces, and afterwards jointed, to any given mould or model.

Be this as it may, the construction of "steam" vessels of strong sheet iron is evidently much on the increase, particularly here and at Glasgow, the two ports that were the first, we believe, in this country, and are still the most successful, (being put to their "metal") in directing their energies to steam navigation. The "iron fleet" of England is consequently receiving rapid accessions; and not contented with turning out one vessel at a time, Mr. John Laird, has several on the stocks at once, and on Saturday morning, 6th ultimo, launched two from his yard at North Birkenhead by the same tide! The time appointed (the tide being early) was about nine o'clock, and by that hour a large concourse of persons, including many ladies and gentlemen from the neighbourhood, and not a few from this side of the water, were in attendance. Both the vessels were decorated with flags, and some parties, besides the workmen, preferred going on board and being launched with them.

The first one launched was her Majesty's steam-vessel *Dover*, to be placed on the station between Dover and Calais, or Ostend. The following are her dimensions and capacity:—

Length (per measurement)	110 feet
Breadth, or beam do.	21 feet
Will admeasure about	230 tons.

The Dover is the first iron vessel belonging to the Admiralty, and on her success will, no doubt, depend the future adoption of vessels of her build by the government. She is of a remarkably fine model, having a degree of rotundity in her sides, with ample bearing, and a fineness in her lines, fore and aft, which will, in all probability, ensure her a degree of speed and safety not yet attained by any steam-vessel of her size. A few minutes after nine the word was given, and she rushed into her destined element in gallant style, amidst the hearty cheers of the spectators, followed by a salute fired from cannon on the quay adjoining the yard.

The second vessel launched was the *Phlegethon*:—

Length (per measurement)	157 feet 6 inches.
Breadth	26 feet.
Capacity, upwards of	500 tons.

She is intended for sea and river service, on, we believe, a foreign station, and will carry two long guns, one at the bow and one at the stern, to work within a circle. This vessel is also of a fine model, with ample bearings, so that she may carry sail when required, either with steam or without it, as her paddle-wheels, on a new principle, by Mr. Forrester, may, when required, be thrown out of gear. She is handsomely, and we may add, rakishly rigged as a two-masted schooner, and will, we doubt not, prove to be a clipper.

She was launched about half-past nine o'clock, and the sight was one of the most gratifying ever beheld. She had a considerable distance to run down the ways before her forefoot reached the water, which she took like a swan breasting its native lake. We need scarcely say that the welkin again rang with the acclamations of the spectators, who lined the yard and the neighbouring shores, and which were returned with equal enthusiasm by those who stood on her decks. When afloat, the impression she conveyed from her length and sharpness, was that of a very fast and mischievous looking craft. She has a fine flush deck, and her paddle-boxes do not rise to an unseemly height over her gunwale.

We believe this is the first instance of two iron vessels being launched from the same slip by the same tide, nor do we recollect a case occurring in Liverpool of two wooden vessels of so large size being launched in one tide.

Both vessels exhibit many improvements in their construction, not tried in any iron vessel previously built; and which render them two of the strongest iron vessels afloat. They are now receiving their machinery,—the Dover, from Messrs. Fawcett, Preston & Co., and the Phlegethon from Messrs. Forrester & Co's establishment. Both, it is expected, will be ready in the course of the present month.

Mr. Laird is now building three iron steam-vessels to compose the new expedition about to be sent by government up the river Niger, under the command of Captain Trotter.—*Liverpool paper*.

The Archimedes.—This experimental vessel is gradually working its way all round the coast, exhibiting its powers at the principal ports. It was at Liverpool last month. On the 10th ult., we find by the *Liverpool Standard*, she made a trip, and shortly before reaching the Crosby Light-ship, the Duchess of Lancaster steam-ship was perceived making directly for the port, and as she was known to be a remarkably fast sailer, and Mr. Smith being desirous of proving the capabilities of the Archimedes, immediately 'put about,' and awaited the arrival of the former vessel. On coming up, the screw was immediately put in motion, and the two vessels went admirably together for some distance, though we are bound in fairness to state that the Duchess had a very slight advantage in respect of speed, owing, as will be seen from the subjoined comparison, to her proportions as to power, draught, &c., being better adapted for quick sailing. The Archimedes had also the full strength of the tide to contend with, whilst her competitor ran the whole distance in the eddy. This is the first time the Archimedes has been beaten, with one or two slight exceptions.

ARCHIMEDES.		DUCHESS OF LANCASTER.	
Diameter of cylinder	37 in.	Diameter of cylinder	40 in.
Stroke	3 ft.	Stroke	3 ft.
Tonnage....................	237	Tonnage....................	238
Draught	10 ft.	Draught....................	6 ft.
Estimated steam-power ..	80-horse	Estimated steam-power ..	90-horse
Length between perpendiculars	107 ft.	Length between perpendiculars	120 ft.
Beam	22ft. 6 in.	Beam	20 ft.
Area of midship section at 10 feet draught............	143 ft.	Area of midship section at 6 feet draught	100 ft.

As there was a feeling on board relative to the slip or loss of power from the screw, the following explanation will doubtless be satisfactory:—The screw, being 8 feet pitch, would, if working in a solid, advance 8 feet for each revolution; but, working in a fluid, the relative difference between the speed of the screw and the vessel appears, *at first sight*, to be considerable, from the *supposed* oblique action of the propeller. The following mode of calculating the speed of both will show that the difference is barely one-sixth, which is considerably less than that of ordinary paddle-wheels.

imber of revolutions of the engine per minute is 26, which, multi-
ie spur wheels $5\frac{1}{3}$ times, gives that number of turns to the screw
the engine.

26 revolutions of the engine per minute.
$5\frac{1}{3}$ multiple.

138 revolutions of the screw per minute.
8 feet pitch of screw.

1104 *feet* travelled per minute.
20 being $\frac{1}{3}$ of 60, to bring it into

22,080 *yards* per hour,
ded by 1760 (the number of yards in a statute mile), gives us 12
rards per hour as the speed of the screw. Speed of the vessel for
per minute, 10 10-25 miles per hour by the log."—She left Liverpool
ult., for the Isle of Man, and performed the run in the short space of
s and 25 minutes, which is an unusually quick passage. The *Mona's*
lly two hours longer doing the same distance on the same day,
out half an hour later than the *Archimedes*. The *Mona* is 10 horses
e than the *Archimedes*, with considerable less tonnage, and draw-
et less water.

il Steam Packets.—The contract of the "Royal Mail Steam-packet
' with the commissioners has just been printed, in return to an
e House of Commons. The company covenant to keep a sufficient
t less than 14) of good and efficient steam-vessels, which shall be
ry guns of the largest calibre now used on board of steam-vessels
plied with engines of not less than 400 collective horse power, as
h men, apparel, &c., and be of at least 1,000 tons burden. One of
ls is to leave a port in the British Channel twice in every calendar
l proceed to Barbadoes, as soon as the mails are on board. After
not exceeding six hours from her arrival there, she is to proceed
, and after remaining a time not exceeding 12 hours, go with the
ard to Santa Cruz, thence to St. Thomas's, thence to Nicola Mole
ence to Santiago de Cuba, and thence to Port Royal in Jamaica.
ining at Port Royal for an interval not exceeding 24 hours, the
r delivering her mails and receiving others, is to proceed to Savan-
, and after a delivery and receipt of mails there, to Havannah in
er an interval not exceeding 48 hours she is on her return to pro-
Havannah to Savannah la Mer, thence to Port Royal, thence to
e Cuba, thence to Nicola Mole, thence to Samana in Hayti, de-
d receiving mails at each place, care being taken that she shall
ive at Samana, after performing her voyage from Barbadoes, on
lay after the arrival of the mails at Barbadoes from England.
na she is to make the best of her way back to England. Imme-
the arrival at Barbadoes of every steamer employed under the
nother of such steam-vessels is to proceed with her mails from
uccessively to Tobago, Demerara, Berbice, and Paramaribo. The
elay at Paramaribo is not to exceed 48 hours, and then the vessel
d to Berbice, Demerara, Tobago, Grenada, and Barbadoes, always
Barbadoes in time to depart immediately for Tobago on the arrival
e vessels at Barbadoes from England. On the arrival at Grenada
from England, another of the steam-vessels is to proceed from
cessively to St. Vincent, St. Lucia, Martinique, Dominica, Guada-
gua, Montserrat, Nevis, St. Kitt's, Santa Cruz, Tortola, St.
St. Juan's (in Puerto Rico), Samana, Curaçoa, Porto Cabello, La
nidad, and thence back to Grenada, so as always to be ready to
ce with the mails on their arrival from England. Another vessel
the arrival at Grenada of the mails from England, is to proceed
ails successively to the Port of Spain (in Trinidad), La Guayra,
llo, Curaçoa, Samana, St. Juan's, St. Thomas's, Tortola, Santa
itt's, Nevis, Montserrat, Antigua, Guadaloupe, Dominica, Marti-
ucia, St. Vincent, and thence back to Grenada, so as to be ready
mediately on the arrival of a mail from England. On the arrival
l at Curaçoa from Grenada, a sailing vessel is to be ready then
rom Curaçoa to Santa Martha, and thence to Carthagena, where
emain 24 hours, and then return to Santa Martha and Curaçoa.
val of a mail from England at Nicola Mole, another sailing vessel
l thence to the Bahama Islands, and after remaining at New Pro-
not more than 72 hours, return to Nicola Mole in time to meet the
l. On the arrival of the mail from England at Port Royal, another
l is to proceed thence to Chagres, Carthagena, Santa Martha, and
to Port Royal in time to meet the return vessels from Havannah.
val of the mails from England at Savannah la Mer, another sail-
to proceed thence to Trinidad de Cuba and Belize (in Honduras),
remaining 48 hours, she is to return to Savannah la Mer by the
On the arrival at Havannah of the mails from England, another
l is to proceed thence with the mails to Vera Cruz, Tampico, Mo-
other port as the commissioners shall determine, returning from
t to Havannah in time to depart for Vera Cruz immediately on
f the English mail, and another to the Gulf of Mexico, Tampico,
ruz, and then back to Havannah to meet the mails. Another
et, on the arrival of the mails from England at Havannah, is to
Mantanzas in Cuba, and to New York, stopping at intermediate
named by the commissioners, and thence to Halifax, returning
annah, by the same route on the arrival of the mails from Eng-
contract is to commence on the 1st of December, 1841, or at an
d, if mutually agreed, and to continue in force for ten years from
on which the first vessel shall put to sea for Barbadoes, and for
iod, unless determined by twelve months' notice in writing.

on of the Mails to North America.—The contract entered into about
th since for the conveyance of the mails by steam-packets of 300
and upwards from England to North America will come into
mediately, the Britannia steam-ship having arrived at Liverpool
to carry out the first mail: she is to be followed by the Arcadia, Caledonia and Columbia, all large and powerful vessels. The terms of the contract are, that the mails shall be conveyed twice in every month from Liverpool to Halifax in Nova Scotia, and from Halifax to Boston in the United States, and, while the St. Lawrence is navigable in smaller steam-vessels, from Pictou in Nova Scotia to Quebec in Canada. The mails to return by the same route, twice a month to Liverpool. The contract is for seven years certain, and the contractor is to be paid for performing this service at the rate of 60,000*l*. per annum.

Steam to Alexandria, Egypt.—The steam ships *Oriental* (late the *United States*) and *Liverpool*, have been engaged by government to carry the mails between England and Egypt. The *Oriental* will be ready to sail from Falmouth for Alexandria on the 1st of August, to be succeeded by the *Liverpool*, which will depart on the 1st of September. These vessels will call at Gibraltar and Malta, in going and returning; and they are to be only 15 days on the passage to Egypt, and the same time on that back to England. Both ships will, it is expected, sail regularly from and to this port, calling at Falmouth to receive and deliver the mails and passengers; so that one may shortly take a trip hence direct to Egypt, and behold, in a brief visit, all the wonders of that once glorious land.

PROGRESS OF RAILWAYS.

ATMOSPHERIC RAILWAY.

We attended on Thursday, the 11th ult., at Wormholt Scrubbs, to witness an experiment on a portion of the Birmingham, Bristol and Thames Junction Railway, which had been laid down by Messrs. Clegg & Samuda, on their patent atmospheric principle; as might have been expected, the practical introduction of a system so different from that now in use on other railways, excited considerable interest.

The idea of employing the power of the atmosphere, against a vacuum created in an extended pipe, laid between the rails, and communicating the moving power thus obtained to propel carriages travelling on a road, we believe originated with Mr. Medhurst, who laid before the public details of his plan in a work he published in 1827, entitled "A New System of Inland Conveyance"; indeed so far back as 1812 he published some ideas on this method of locomotion. About 1835 some experiments were made with a model in Wigmore Street, by Mr. Pinkus, very similar to those described by Mr. Medhurst; these experiments, however, failed, from the same cause which probably prevented Mr. Medhurst from carrying his into effect, viz., the impossibility of making the continuous communication from the inside of the pipe to the carriage tight enough to allow a useful degree of rarefaction to be produced. Messrs. Clegg & Samuda's invention overcomes this difficulty in a very simple manner; indeed the constructing and closing this continuous valve, by *hermetically sealing it up with a composition* each time a train passes, forms the main feature in their invention.

The portion of the line selected on which the experiments were made is half a mile long, with a rise of 1 in 120 for rather more than half the distance, and 1 in 115 for the remainder. A continuous cast iron pipe or tube 9 inches in diameter, is fixed between the rails, and bolted to the sleepers which carry the rail chairs; the inside of this pipe, which is unbored, is lined with a strong lubrication of pressed tallow about $\frac{1}{10}$ of an inch thick, which equalizes the surface, and prevents any unnecessary friction from the passage of the travelling piston through it; along the upper surface of the pipe is a continuous slit or groove about $1\frac{1}{2}$ inch wide. This groove is covered by a valve extending the whole length of the railway, formed of a strip of leather rivetted between iron plates, the top plates being wider than the groove, and serving to prevent the external air forcing the leather into the pipe when the vacuum its formed within it, and the lower plates fitting into the groove when the valve is shut, makes up the circle of the pipe, and prevents the air entering the tube; one edge of this valve is securely held down by iron bars fastened by screw bolts to a longitudinal rib cast on the pipes, and thus allows the leather between the plates and the bar to act as a hinge, similar to common pump valves; the other edge of the valve falls into a groove which contains a composition of bees-wax and tallow; this composition is solid at the temperature of the atmosphere, and becomes fluid when heated a few degrees above it. Over this valve is a protecting cover, which serves to preserve it from snow or rain, formed of thin plates of iron about 5 feet long, hinged with leather, and the end of each plate underlaps the end of the next in the direction of the piston's motion, thus insuring the lifting of each in succession. To the underside of the first carriage in each train is attached the piston and its appurtenances; about six feet behind the piston, the horizontal piston-rod is attached to a connecting arm which passes through the continuous groove in the pipe, and being fixed to the carriage, imparts motion to the train as the tube becomes exhausted of the air; attached to the piston rod, and preceding the connecting arm, two steel wheels are fixed, which serve to lift the valve to allow the connecting arm to pass, and also for the atmospheric air to impinge immediately on the back of the piston; another steel wheel, which is attached to the carriage by a spring, serves to ensure the closing of the valve, by running over it immediately after the piston has passed, in case it should not fall by its own weight. A copper tube about 10 feet long, which is constantly kept hot by a small stove, also fixed to the under side of the carriage, passes over the surface of the composition (which has been broken up by lifting the valve out of it), and rendering it fluid, which, upon again cooling, becomes solid and hermetically seals the valve. Thus each train, in passing, leaves the pipe and valve in a fit state to receive the next train.

For the purpose of exhausting the tube a steam engine of 16 horse power is employed, which works an air-pump or exhauster $37\frac{1}{2}$ inches diameter, and $22\frac{1}{2}$ inches stroke, making from 40 to 43 strokes per minute. The air-pump is connected with the exhaust tube in the centre of the railway, by means of a branch pipe 9 inches diameter leading from the air-pump.

To calculate the power of this kind of apparatus, it is nescessary to ascertain the state of vacuum and the difference of the pressure of the atmosphere which forces the piston forward; in the present experiments the vacuum was equivalent to from 18 to 20 inches of mercury, which will give for the useful pressure of the atmosphere on the piston about 9 lb. on the square inch. The area of the tube, 9 inches diameter, is equal to 63·62 square inches, and this multiplied by the pressure, will give

$$9 \times 63{\cdot}62 = 572{\cdot}58 \text{ lbs.}$$

for the pressure on the back of the piston, or the moving power.

The load conveyed at each experiment may be taken as follows:—

Two carriages........................ = 4 tons.
Apparatus attached .... = 1 ton.
Forty-five passengers .... = 3 tons.

Total load conveyed .... = 8 tons.

The stationary engines and air pumps on this system may be fixed in distances varying from one to four miles apart, to suit the traffic and convenience of the line of road; each section or length of pipe acted on by one engine is confined between two valves; the vacuum is created to about 18 to 20 inches of mercury before the piston enters the pipe, and is maintained during the passing of the train by the engine being kept at work; having passed through one section of pipe, the momentum the train has attained, serves to carry it on to the next section, which commences at about 100 or 200 yards beyond, and the entrance separating valve of the second section being opened by the carriage immediately after it has entered, allows the vacuum prepared in this section to act upon the piston; thus the train can pass from section to section without end, and without any stoppage.

Experiments.—For the purpose of ascertaining the relative velocity on various portions of the half mile, it was divided into 20 sections of 2 chains or 44 yards each. The carriages were started from a state of rest at the foot of the inclined plane of one in 120, and allowed to run up the incline of half a mile before the break was applied to arrest the progress of the carriages. When two carriages were attached, they run over the ground, after passing the first 5 divisions at the velocities of 7, 6, 5, and 4 seconds to each section, which is equivalent to 13, 15, 18, and $22\frac{1}{2}$ miles per hour; and when *one* carriage only was attached, it run over the ground at the velocities of 6, 5, 4, and 3 seconds to each division, which is equivalent to 15, 18, $22\frac{1}{2}$, and 30 miles per hour. The last division in each experiment was done at the greatest velocity, which clearly shows that had the experiment been made on a mile run instead of a half mile, the experiment would have been far more favourable and satisfactory; and if the experiment had been made on a level, about four times the above load might have been conveyed at the same velocity.

We noticed that it took about $1\frac{1}{2}$ minute to raise the vacuum each trip, to about 18 inches of mercury.

From the above experiments, the loads drawn, and the speed attained, will be as good a criterion of the success of the undertaking at we can have, and when we consider that in producing these results, the patentees must have been wholly unassisted by any previous examples, we think that the greatest credit is due to the talent and ingenuity they have displayed. The system appears to us to possess many advantages which must insure it the serious consideration of the engineer. The carriages travel without noise, and without the risk of explosion, or of getting off the rail. It does not seem possible that a collision of trains can take place, for two trains cannot receive power from the same section of pipe at the same time, neither can they receive power in opposite directions on the same rail. The speed on this system must be proportioned to the capacity of the air-pumps used to maintain the exhaustion in the tubes, and therefore any rate of travelling that may be deemed desirable may be easily attained.

French Railways.—The Railway Committee held another meeting last week in Paris, and after hearing parties interested in the five companies affected by the Government bill, took into special consideration that part of the measure which relates to the lines from Lille and Valenciennes to the Belgian frontiers. The Committee approved of these two lines being executed by Government, not only on account of precautions that might be rendered necessary by the defence of the frontier; but also because the formation of treaties with Belgium might render it desirable that these lines should be in the hands of the State. The Committee was of opinion that the termination of these lines was the more called for, since the Belgian lines to the frontier were already executed. The line from Lille to the frontier near Mouscron is 14,125 meters in length, or 47,000 English feet; and that from Valenciennes to the frontier near Quievrain is 63,128 metres, or 43,000 feet; the first is to cost 1,000,000f., the latter 4,000,000f. The Committee adopted this part of the bill almost unanimously, as also the lines and surveys as approved of by the administration of the Ponts et Chaussees.—*Railway Times.*

Llanelly Railway.—The present state of the new line is as follows:—From the Dock at Llanelly to Parkrhyn (main line) eleven miles, and from thence up to the terminus of Cwm Amman branch, six miles, altogether seventeen miles, the line has been completed and open for traffic, over which the locomotive engines of the Company are travelling.—From that point, viz. Parkrhyn, up to Duffryn Lodge (about a mile and a half further on the main line) the same is nearly completed, the rails having been laid, and the filling in in progress.—From that point on the main line, viz., Duffryn Lodge, the branch leading to Mr. Long Wrey's collieries, and Messrs. Morris, Sayce, and Co.'s, is in course of forward progress, and will be completed by 1st January next, this branch is altogether about four miles in length, and leads to several collieries of capital coal. The Company have entered into a contract with Mr. Wrey, to bring for seven years at least 10,000 tons yearly down this branch, which will yield railway and dock dues, as a minimum amount, the sum of 1,000*l.* per annum—The two new locomotive engines to which reference was made in the last annual Report as then ordered, are now at Llanelly, and one of them, the *Albert*, is engaged in traversing the line, in hauling coal down to Llanelly. The Committee are persuaded that the carrying trade which will thus be secured to them by locomotive power, will be a source of profit when the quantity of coal, iron, &c., shall be increased: whilst as an auxiliary to the general traffic the use of steam power is unquestionably of great importance.—*Directors Report.*

Preston and Wyre Railway.—The Directors have made an arrangement for one year with the North Union Railway to supply this Company with locomotive engines at 2*s.* 4*d.* per mile per train. and with the first-class carriages at a penny per mile each, and with second-class at a halfpenny per mile each. This will prevent the present outlay of a considerable capital, a circumstance particularly desirable until the extent of the traffic on the line has been ascertained.

Great North of England Railway.—The works of the Great North of England Railway between York and Darlington, are in so forward a state, that the Directors of the Company have employed Mr. Green, of Darlington, architect, to furnish designs for depôts upon the line.—*Leeds Intelligencer, May* 30.

The Cheltenham Railways.—Within the last few days the bank which separated the Birmingham and Gloucester works from the Cheltenham and Great Western, between the station and Lansdown Bridge, has been cut through, from which circumstance we should infer that a satisfactory arrangement has been entered into by the two Companies. The greatest exertions are making to complete the work up to the Lansdown bridge, and from the number of hands employed, and the activity displayed, we should fancy that a very short space of time will suffice for the attainment of that object.—*Cheltenham Journal.*

Locomotive Carriage.—Mr. Hills lately made a very successful trip to and from Camberwell and Brighton with his patent locomotive carriage, the distance from Camberwell to Brighton was performed in 5 hours and 10 minutes, out of which time one hour 21 minutes was lost by delays in obtaining a supply of water at the inns, and 10 minutes delay on the road. The return trip was accomplished in 5 hours 22 minutes, out of which time one hour four minutes was lost by delays in obtaining water, and 26 minutes delay by stoppages on the road; the delays in obtaining water will be reduced very considerably, when proper stations and stated periods for arrival are made, the whole of the stoppages need not occupy more than 12 minutes, which, according to the speed the carriage ran on the road, the journey from London to Brighton might be very well accomplished in about three hours and a half. Our correspondent, who accompanied Mr. Hill on his trip to London, states that the form of the carriage is a handsome britzka, that there is scarcely any noise from the working of the engine, or escape of steam, and no appearance of smoke; on descending hills it is easily regulated by powerful retarders, and guided with the greatest facility. We hope at some future time to be able to give some additional information connected with the cost of a carriage, and the working of the same.

NEW CHURCHES, &c

Plymouth.—On Tuesday 20th May the foundation stone was laid of a new Church in Southside-street. in this borough, and which is to be called "Trinity Church." From the peculiar circumstances of its locality, it differs greatly from the usual form of New Churches. Its interior may be described as a square of about 70 feet, divided into three parts by two parallel Tuscan colonnades, each surmounted by an attic range of semicircular windows, forming a *clerestory* as in our cathedral churches. The traverse section of the building, therefore, exhibits a nave of about 35 feet high, by 37 feet wide, and two aisles, each about 25 feet high, by 16 feet wide, the galleries being constructed along the latter. The building being surrounded by houses, &c. on the north, south, and west sides, the only light, in addition to that of the clerestories, is derived from three windows at the east end, the central one being a large three-light Venetian window over the altar, which terminates a recess extending about 14 feet eastward from the main body of the church; on each side of the altar projection is an entrance porch; and there is a third porch in the centre of the north side to afford an entrance from Southside-street. The bell turret, surmounting a pediment over the great east window, is in the simple form of an arch flanked by pilasters, and crowned with a small pediment, a repetition of the larger one below. It is anticipated that the perspective of the interior looking from the western end will be boldly picturesque and ecclesiastical; that the effect of the lofty clerestories will be not less striking, than novel, as a modern application of Italian architecture; and that the altar-piece, with its triple Venetian window over, will form an imposing termination to the vista. The church is calculated to afford accommodation for about 1100 sittings, of which 650 are free. George Wightwick, Esq., is the architect.

Northamptonshire.—The Hon. H. Watson, brother of Lord Sondes, with praiseworthy munificence, intends erecting a new church at Guilsborough, entirely at his own expense. The cost of the building, it is said, will amount to upwards of 5,000*l.*

The Temple Church.—This ancient and beautiful edifice is closed, in order to its being thoroughly cleansed, repaired, and restored, externally and internally. We understand that the benchers of the two Temples have determined that no efforts or expense shall be spared in this work of renovation. The richly ornamented Norman entrance, which is unfortunately so hidden by the adjacent buildings, is to be restored to its original perfection. The organ, one of the finest in London, is to undergo a complete examination and repair. Some changes more in keeping with the general style of the architecture are contemplated in the interior of the building; and the interesting monuments, and other decorations and antiquities, of this venerable pile, are to re-appear in a state more worthy of the characters and events they are intended to perpetuate, and more likely to command the attention and admiration of the spectator.

Cornwall.—On Thursday, 28th May last, Christ-church Chapel of Ease, at Lanner, in the parish of Gwennap, was opened. It is from designs by Mr. Wightwick, of Plymouth, in the Anglo-Italian style, neatly finished with granite dressings, having the timbers of the roof-trusses open to view, the under side of the rafters being ceiled, a plan consistent with economy, and affording ample breathing room for the 400 free sitters who occupy it. It has been built by subscription, aided by grants from the Diocesan Board and the Incorporated Society of London.—The foundation stone of another chapel, also from designs by Mr. Wightwick, was laid on Whit-Monday last, at Portreath, in the parish of Illogan, in the county of Cornwall. This chapel is of about the same capacity as the one at Lanner, but in the lancet pointed style; and like the former, is to be entirely occupied with free sittings.—Mr. Wightwick is also engaged in preparing plans for a free chapel in the Anglo-Norman style at Flushing, near Falmouth; and he is superintending the conversion of a building, formerly used as a Unitarian Meeting House, into an Episcopal Chapel, at Falmouth.

Sussex.—The new church in the parish of Lower Beeding, was consecrated on Tuesday, June 2.—The building of the new Chapel of Ease in Horsham is making satisfactory progress, the work being executed in a manner highly creditable to the builder, Mr. Darby.—In the quarry which is worked for the building stone of this chapel, several fossil bones, in good preservation, have lately been discovered. They are supposed to be portions of the Iguanodon. The best specimens have been added to the excellent local collection of Mr. G. B. Holmes.

Lincolnshire.—An addition to Thorney Abbey is now being made, the first stone of which was laid June 24, 1839, in the Norman style of architecture, consisting of a transept across the east end of the present part, which makes the Abbey in the form of a T; it is designed by Edward Blore, Esq., architect. The addition is 63 feet by 30 feet 6 inches, and will have a very handsome painted window, a copy from the one in Becket's crown in Canterbury Cathedral, which was put up in the old part, but was removed in a few months for the present work. The pulpit, reading, and clerk's desks will be at the altar, forming a very handsome screen, altogether executed in wainscot, and the old part painted in imitation of that wood; the fittings are in the Gothic style.

PUBLIC BUILDINGS, &c.

TRAFALGAR SQUARE.

Return to an order of the Hon. the House of Commons, dated June 10, 1840, for a return of the arrangements entered into between the Commissioners of Woods and Forests and the Committee for erecting the Nelson Monument in Trafalgar-square; and also a Statement of the Plan approved and sanctioned by the Commissioners of Woods and Forests for laying out the vacant Space in front of the National Gallery, and whether it will be all or in part open to the Public. Ordered by the House of Commons to be printed, June 15, 1840.

The Lords Commissioners of Her Majesty's Treasury having approved of the designs submitted to them for the Nelson Monument, and of the appropriation of a portion of Trafalgar-square as a site for the same, the Commissioners of Woods, &c., were authorised by Treasury letter, bearing date the 27th of January, 1840, to deliver over such site to the committee. The whole of the arrangements between the Commissioners of Woods and the committee for the erection of the monument up to the present time have been limited to the delivery of the site.

The plans submitted to the Commissioners of Woods, &c., in 1837, by the late Mr. Wilkins, contemplated an architectural appropriation of the square in accordance with, and intended to increase the effect of, the National Gallery. The Commissioners of Woods have adhered to the principle of the plan suggested to them by Mr. Wilkins; but, in consequence of his death, and the subsequent selection of the present design for the Nelson Monument, the Chief Commissioner of Woods, &c., has committed the laying out of the square to Mr. Barry.

According to the plan which he has suggested (and which, as regards the excavation of the ground originally proposed by Mr. Wilkins, is now in progress), the whole of the space in front of the National Gallery, with the exception of the roadways forming its respective boundaries, will be lowered from south to north to the level of the footway leading from Cockspur-street to the Strand. The roadway in front of the National Gallery, and consequently the whole of that building, will, by this arrangement, stand upon a terrace from eight to ten feet in elevation. The access to the square from this roadway will be by a terrace-landing and flight of steps opposite to, and of the width of, the portico of the building. The steps and the sustaining walls, by which it is intended, upon three sides, to enclose the square, will be of granite; the posts with which it is intended to surround the square are also to be of granite, and connected with a bar of iron, as a protection to the respective roadways. The square will be accessible on the north by the steps already mentioned, and on the south by openings to be left between the posts in front of the Nelson Monument. The whole of the area of the square not occupied by that monument is to be either flagged with stone or laid down with asphalte, and will be open to and traversable by the public at all hours of the day.

The whole area to be excavated and appropriated as a place or square will be in extent, from north to south, 250 feet, and from east to west, 340 feet. The site of the column will occupy a space immediately connected with the footway leading from Cockspur-street to the Strand of 82 feet square.

DUNCANNON, { Commissioners of Her Majesty's
CHARLES GORE, { Woods, Forests, Land Revenues, Works
and Buildings.

N.B. The ground removed from Trafalgar-square is applied in levelling and improving the surface of the Green Park.

Office of Woods, &c., June 12, 1840.

[We highly approve of this arrangement, and have no doubt the effect of giving height to the National Gallery in the manner proposed, will greatly improve that building.—Ed. C. E. and A. Journal.]

Rochdale, Lancashire.—A bank and manager's residence, in connection with the Liverpool and Manchester District Banking Company, is in course of erection, from the designs, and under the superintendance of Mr. Harrison, architect, of this town. The building comprises a bank and board-room, strong room, and a private residence. It will present a neat façade to Baillie-street, the lower part being of rusticated masonry, and the whole crowned by a Grecian dentil cornice and blocking course. The contracts are under 1,400*l*.

The National Provincial Bank of England.—This establishment which with its numerous provincial branches, has been in active operation for seven or eight years, has lately taken possession of its new and extensive town premises in Bishopsgate-street, better known as Salvador House, the residence of the late William Mellish, Esq., at whose death the property was sold and purchased by the Company. To render the place suitable for its intended uses, the old houses in front abutting upon the street, and the stables intervening between them, and the mansion have all been taken down, and in their place the present alterations have been made, under the direction of John Burges Watson, Esq., architect. The entrance consists of a carriage and two foot gates, situated between two Greek Doric lodges, that on the south side for a porter, the opposite one, with the new ranges of offices behind, each being about 100 feet in depth, are for the occupation of other officers of the establishment; between the further termination of these and the mansion, (now called the Bank House in contradistinction to the front offices), is sufficient space for carriages to take up and set down. The bank-house is approached by a spacious porch and lobby, and leads to an entrance-hall, which retains its original ceiling with decorated compartments, being in character with the older parts of the house. It is paved throughout with black and white marble; in the right of the entrance, is the public banking room, of large dimensions, and which has been procured by throwing two rooms into one, this affords accommodation for about 40 clerks in addition to the usual counter for cashiers, &c., and enclosures for other functionaries; the whole has been finished in the most complete manner. The walls are jointed and coloured to imitate stone, having mahogany fittings, scagliola pilasters, and a richly decorated cornice; on the left of the hall are waiting rooms, and on the same floor the accomptants' room, inspectors' room, and two strong rooms. The hall leads to the principal staircase, which is unique, and consists of a centre and two side flghts leading to the landing on the first floor, in this staircase the ends of the steps, are carved and a decorated baluster rests on each in which is introduced, a medallion of the late king, in which reign the company was first established, on the obverse is a figure emblematical of commerce. The apartments on the first floor comprise the board-room for directors, the room for sub-committees, manager's room, secretary's room, &c., and the remaining portion of the house forms a residence for one of two of the principal clerks. The pediment, which is of Portland stone, has been added to the Bank-house, and is charged with the Arms of England and Wales, to which portions of the United Kingdom, the operations the Company are limited by Act of Parliament.

Liverpool.—A building for the use of an Institution to be called the Collegiate Institution for the Education of the Commercial Trading and Working Classes, is about to be erected in this town. Designs have been advertised for, and two premiums £50 and £25 proposed. The cost is to be £15,000, and the style of architecture Tudor pointed. The drawings to be sent in on the 1st July.

Ashton-under-Lyne.—A Town-hall is in course of erection here, under the direction of Messrs. Young and Westall, architects of Manchester. The building, which is to be faced entirely with stone, is in the Roman style of architecture; and consists in front of an attached Corinthian colonnade *in antis*, surmounted by a balustrade of the same order, which forms a parapet to the centre of the façade, and is crowned by a group of sculpture. The wings consist of a single interpilaster, and terminate above with a plain parapet. The order itself, which is divided into first and second floor, and is continued uninterruptedly round the edifice, is elevated upon a lofty stylobate. Its proportions are chiefly taken from the Pantheon at Rome. The interior will contain a large room 83 feet by 40 feet, and 28 feet high. It also comprises accommodation for the town's authorities, committees, &c., a constable's residence, fireman's house, and six lockups in the basement, which is principally fire-proof. The works, as contracted for, amount to about £6,000.

Road-Bricks Duty Free.—During a discussion at the last East Riding sessions, on one of the applications relative to parochial highways, it was stated by a surveyor that a request having been made to Government for leave to manufacture bricks free of duty, for the purpose of repairing highways, the Chancellor of the Exchequer had granted the required permission to those parishes in which cliffstone could not be obtained for the purpose of such repairs.—*Stockport Advertiser.*

LIST OF NEW PATENTS.

GRANTED IN ENGLAND FROM 28TH MAY TO 24TH JUNE, 1840.

HENRY AUGUSTUS TAYLOR, of New York, now of Milk Street, Cheapside, Merchant, for "*improvements in the manufacture of braid and plaits.*" Communicated by a foreigner residing abroad.—Sealed May 28 ; six months for enrolment.]

ALEXANDER FRANCIS CAMPBELL, of Great Plumstead, Norfolk, Esquire, and CHARLES WHITE, of the city of Norwich, Mechanic, for "*improvements in ploughs and certain other agricultural implements.*"—May 28 ; six months.

SIR JOSIAH JOHN GUEST, of the Dowlais Iron Works, Glamorgan, Bart., and THOMAS EVANS, of the same place, Agent, for "*certain improvements in the manufacture of iron and other metals.*"—May 28 ; four months.

EDMUND LEACH, of Rochdale, Lancaster, Machine Maker, for "*certain improvements in machinery or apparatus for carding, doubling, and preparing wool, cotton, silk, flax, and other fibrous substances.*"—May 28 ; six months.

DANIEL GOOCH, of Paddington Green, Engineer, for "*certain improvements in wheels and locomotive engines to be used on railways.*—May 28 ; six months.

WILLIAM HENRY SMITH, of York Road, Lambeth, Civil Engineer, for "*an improvement or improvements in the mode of resisting shocks to railway carriages and trains, and also in the mode of connecting and disconnecting railway carriages, also in the application of springs to carriages.*"—May 28 ; six months.

GEORGE HENRY BURSILL, of River Lane, Islington, Gentleman, for "*an improved method or methods of weighing, and certain improvements in weighing machines.*"—May 28 ; six months.

JAMES ALLISON, of Monkwearmouth, Durham, Iron Master, and ROGER LUMSDEN, of the same place, Chain and Anchor Manufacturer, for "*improvements in the manufacture of iron knees for ships and vessels.*"—May 30 ; six months.

JOHN BAPTIST WICKS, of Leicester, Frame-work Knitter, for "*improvements in machinery employed in frame-work knitting or stocking fabrics.*"—May 30 ; six months.

WILLIAM PETTITT, of Bradwell, Bucks, Gentleman, for "*a communicating apparatus to be applied to railroad carriages.*"—May 30 ; two months.

JOHN HAWLEY, of Frith Street, Soho, Watch Maker, for "*improvements in pianos and harps.*" Communicated by a foreigner residing abroad.—June 1 ; six months.

PIERRE DEFAURE DE MONTMIRAL, of London Wall, Gentleman, for "*certain improvements in the manufacture of bread.*" Communicated by a foreigner residing abroad.—June 2 ; six months.

RICHARD FREEN MARTIN, of Derby, Gentleman, for "*certain improvements in the manufacture of certain descriptions of cement.*"—June 2 ; six months.

SAMUEL SALISBURY EGALES, of Liverpool, Engineer, for "*certain improvements in obtaining motive power.*"—June 2 ; six months.

JAMES HARVEY, of Basing Place, Waterloo Road, Timber Merchant, for "*certain improvements in paving streets, roads, and ways, with blocks of wood, and in the machinery or apparatus for cutting or forming such blocks.*" —June 2 ; six months.

WILLIAM SOUTHWOOD STOKER, of Birmingham, for "*certain improvements in machinery applicable to making nails, pins, and rivets.*"—June 2 ; six months.

CHRISTOPHER DAIN, of Edgbarton, Warwick, Gentleman, for "*certain improvements in the construction of vessels for containing and supplying ink and other fluids.*"—June 2 ; six months.

JAMES ROBERTS, of Sheffield, Merchant, for "*an improved mode of fastening certain kinds of horn and hoof handles to the instruments requiring the same.*"—June 3 ; six months.

SAMUEL WAGSTAFF SMITH, of Leamington, Iron Founder, for "*improvements in apparatus for supplying and consuming gas.*"—June 9 ; six months.

ROBERT HAMPSON, of Mayfield Print-Works, Manchester, Calico Printer, for "*an improved method of block-printing on woven fabrics of cotton, linen, silk, or wollen, or of any two or more of them intermixed, with improved machinery, apparatus, and implements for that purpose.*"—June 9 ; six months.

ALEXANDER SOUTHWOOD STOKER, of Birmingham, for "*improvements in the manufacture of tubes for gas and other purposes.*"—June 9 ; six months.

CHRISTOPHER NICKELS, of York Road, Lambeth, Gentleman, for "*improvements in the manufacture of braids and plaits.*" Communicated by a foreigner residing abroad.—June 9 ; six months.

THOMAS EDMONSON, of Manchester, Clerk, for "*certain improvements in printing presses.*"—June 9 ; six months.

JOHN GEORGE SHUTTLEWORTH, of Feamley Place, Glossop Road, Sheffield, Gentleman, for "*certain improvements in railway and other propulsion.*"—June 9 ; six months.

FRANCIS GREAVES, of Radford Street, Sheffield, Manufacturer of Knives and Forks, for "*improvements in the manufacture of knives and forks.*"—July 11 ; six months.

WILLIAM LANCE, of George Yard, Lombard Street, Insurance Broker, for "*a new and improved instrument or apparatus, to be used in whale fishery, part or parts of which, upon an increased scale, are also applicable as a motive power for driving machinery.*"—June 11 ; six months.

BENJAMIN WINKLES, of Northampton Street, Islington, Copper Plate Manufacturer, for "*certain improvements in the arrangement and construction of paddle-wheels, and water-wheels.*"—June 11 ; six months.

JOSEPH WOLVERSON, of Willenhall, Stafford. Locksmith, and WILLIAM RAWLETT, of the same place, Latch-maker, for "*certain improvements in locks, latches, and other fastenings for doors.*"—June 13 ; six months.

EZRA JENKS COATES, of Bread Street, Cheapside, Merchant, for "*certain improvements in propelling canal and other boats.*" Communicated by a foreigner residing abroad.—June 13 ; six months.

EDWARD JOHN CARPENTER, of Toft Monks, Norfolk, a Commander in the Royal Navy, for "*improvements in the application of machinery for assisting vessels in performing certain evolutions upon the water, especially tacking, veering, propelling, steering, casting or winding, and backing astern.*"—June 13 ; six months.

RICHARD BEARD, of Egremont Place, New Road, Gentleman, for "*improvements in apparatus for taking or obtaining likenesses and representations of nature and drawings and other objects.*" Communicated by a foreigner residing abroad.—June 13 ; six months.

RICHARD PROSSER, of Birmingham, Civil Engineer, and JOHN JAMES RIPPON, of Wells Street, Middlesex, Ironmonger, for "*certain improvements in apparatus for heating apartments, and in apparatus for cooking.*"—June 17 ; six months.

RICHARD PROSSER, of Birmingham, Civil Engineer, for "*certain improvements in manufacturing buttons for certain materials, which improvements in manufacturing are applicable in whole or in part to the production of knobs, rings, and other articles from the same materials.*"—June 17 ; six months.

THOMAS DE LA RUE, of Bunhill Row, Manufacturer, for "*improvements in printing calicoes and other surfaces.*"—June 20 ; six months.

JOHN AITCHISON, of Glasgow, Merchant, and ARCHIBALD HASTIE, of West Street, Finsbury Square, Merchant, for "*certain improvements in generating and condensing steam, heating, cooling, and evaporating fluids.*"—June 24 ; six months.

WILLIAM HICKLING BENNETT, of Wharton Street, Bagnigge Wells Road, Gentleman, for "*improved machinery for cutting or working wool.*"—June 24 ; six months.

WILLIAM WOOD, of Wilton, Carpet Manufacturer, for "*certain improvements in looms for weaving carpets and other fabrics.*"—June 24 ; six months.

WILLIAM ASH, of Sheffield, Manufacturer, for "*certain improvements in augers, or tools for boring.*" Communicated by a foreigner residing abroad. June 24 ; six months.

JOSEPH LEESE, Jun., of Manchester, Calico Printer, for "*certain improvements in the art of printing calico and other surfaces.*"—June 24 : six months.

TO CORRESPONDENTS.

ERRATA IN LAST MONTH'S JOURNAL.

The 11 last lines of col. 1, p. 194, ought to have been placed at the *top* of the column.

Page 195, col. 2, 14 lines from the bottom, for "*more than,*" read "*less than.*"

Page 196, col. 1, 26 lines from the bottom, for "*I with deference,*" read "*With deference.*"

Page 213, col. 2, 18 lines from the bottom, for "*diameter*" read "*circumference.*"

We have received a letter from Mr. Peppercorne *on the subject of our review of his pamphlet on the supply of water to the metropolis. He seems entirely to have misundertood what we said ; in mentioning his "temerity" in proposing a plan for filtering Thames water, we only intended to give him an ironical hint that he had, by such proposition, placed himself in the category of those "artful and mischievous persons," who raise doubts as to the purity of Thames water.*

Communications received from Mr. East, Mr. Sheppard, Mr. Neville, Mr. Barrett, *and* B., *will be inserted next month.*

The Drawings of the Bridge over the River Dove, do not enter sufficiently into detail to render them suitable for the Journal.

We shall be happy to receive, from our correspondent at Liverpool, the notice he offers.

We thank Mr. Radford *and* E. *for their attention.*

We continue to receive several communications on the subject of competition, which would half fill our Journal, and the insertion of them, we are fearful, would not be of much service. The remedy lies with the profession as a body.

Mr. Phillips *will find an acknowledgment of his communication in last month's Journal ; it is unavoidably deferred.*

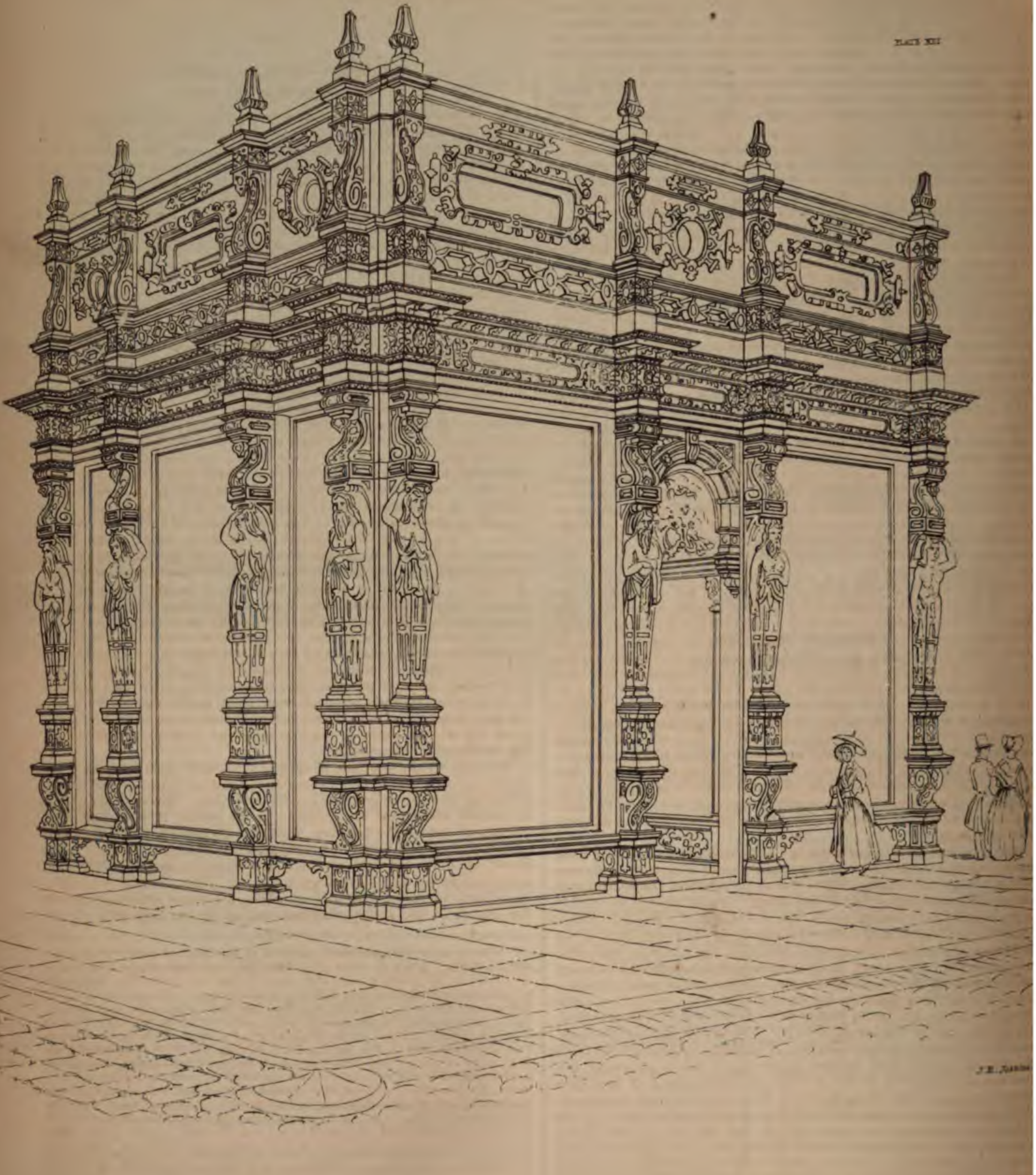
Communications are requested to be addressed to "The Editor of the Civil Engineer and Architect's Journal," *No.* 11, *Parliament Street, Westminster.*

Books for review must be sent early in the month, communications on or before the 20th (if with drawings, earlier), and advertisements on or before the 25th instant.

THE FIRST VOLUME MAY BE HAD, BOUND IN CLOTH AND LETTERED IN GOLD. PRICE 17*s*.

⁂ THE SECOND VOLUME MAY ALSO BE HAD, PRICE 20*s*.

PLATE XXI



J. R. Jobbin

ELIZABETHAN SHOP FRONT.

CORNER OF OXFORD STREET AND BERNERS STREET.

With an Engraving, Plate XIII.

Our readers will recollect that last year the decline of the Louis Quatorze style, and approaching rise of the revival was announced in the Journal, and already to a certain extent is this realized, the Louis Quatorze after a long and widely extended rule has already gone to the tomb of its predecessors, and will leave scarcely a wreck behind. Known to us only in one of its very worst forms, that of its decline during the reign of Louis the Fifteenth, it became here the most unmeaning and unintellectual mass of patching and gilding by which the public taste has ever been perverted. Still, such as it was, it was a style harmonizing with itself however low in its degree, and as symmetry even in a morrice or a chimney sweeper's dance will attract the public, we need not wonder that it was so successful, when we have been so often tortured by styles that show no style at all. Perhaps the reign of this trumpery was one of the evils leading to good, one of the accidents in our artistical destiny which is to minister to our future progress, for it may have taught the public a greater feeling for unity of purpose, and may so far have performed a useful duty.

Slowly the revival has entered upon its career, and it is already evident that it is destined to be popular, and to take its place among the passing fashions of the age. We are inclined to view its advent with the greater pleasure as it is at any rate higher in the scale than its predecessor, but we must not be considered as pledging ourselves to an admiration of it per se, or a vindication of it as a paragon of art. We are not so enthusiastic as our French neighbours, nor so much disposed to succumb to the fashion of the hour, we like the revival, not for itself, not even for the good it may do, but as a type of the coming of that better time of art, which is still we fear too distant, we look upon it as one of the sets of artistical dumbells, with which the public taste must be invigorated, rubbishy materials with a tawdry outside, but which still in their exercise fortify our intellectual strength and health. If we thought this style of itself calculated to produce any permanent influence, if we thought it a part of the lesson to be retained in after years, we should be prepared to denounce its errors in all their extent, to expose its meritriciousness, to strip it of its tinsel gewgaws, and to point it out as a stumbling-block to be avoided. For we are convinced that there is nothing more to be dreaded than the system of swimming with corks, particularly if bad ones, for we are sure to cling to their use, or to recur to their aid, when we ought long since to have flung them totally away. The revival has the advantage of its predecessor, that instead of representing foreign and unknown associations, it appeals to those which are common to all countries and all ranks. It is more intellectual in its scope, is obliged to refer back to higher sources, and requires the exercise of a better class of art, so that if we reap no other fruit, we shall have the advantage in more practised workmen, and in the demand for a greater degree of instruction. The schools of design could never have come at a better time than when their capabilities are likely to be so much called out. So much is the style of revival in advance of English workmen, that when, as we mentioned last year, its introduction was seriously contemplated, it was feared that it would be necessary to import the artisans as well as well as the style. We hope, however, to see a different state of things.

Most of our readers have seen the shop in Regent-street, we have now to call their attention to another in the same style, that of Messrs. Battam, Craske and Coleby, decorators, at the corner of Oxford and Berners-streets, represented in the engraving. As the details are visible in the engraving, we shall merely describe the materials employed, a knowledge of which as a point of economy is most important to our architectural readers. The general ground of the whole including the mezzanine story is of wood, parts of the upper dressings as the trusses and dressings to lights are of cement, and the rest of paste composition. The enrichments of the entablature, mouldings, modillions, block dressings, heads, &c. are in paste; part of the lower dressings in deal, the figures cast in Atkinson's cement. The whole was designed and executed by Messrs. Jackson and Son, of Rathbone-place, and we think will not only get for them present applause, but future patronage, the task was arduous, and as far as they are concerned, they have performed it well. We wish, however, that both here and in Regent-street, the character of the style had been kept up in colour as well as in form, as otherwise our works will be but the mere ghosts of the Parisian style. We hope no fear of the expense will deter tradesmen from having the decorations complete, for we are convinced that they would derive more benefit from a properly finished building than from the dead white phantoms that have been produced. These want all the light and all the life of the style, they want that provocative to luxurious appetite that leads us into the Parisian shop whether we will or not. The shutters are Bunnett and Corpe's patent, and which when down take greatly from the effect, a defect avoided in the original design, which provided embossed, pannelled and moulded shutters in accordance with the general character.

EXHIBITION—ROYAL ACADEMY.

(Concluded from page 222.*)*

Many architects seem to entertain as great a horror of exhibition as Bartholomew does of competition, in regard to which he is even rabidly furious. How else happens it, that among the number of designs sent to the Academy, we invariably meet with so exceedingly few which afford us any information as to public buildings and other works that have either been just completed, or are in progress in different parts of the country? Why does not Mr. Pugin, for instance, we ask, exhibit, by way of *contrast*, and for the needful edification of his Protestant brethren in the profession, some of those Catholic chapels "in the purest taste," on which he recently has been, or is now, actually employed?* We miss several things that, if we may trust what we have heard concerning them, we think would have been creditable to their authors, and should have been glad to find here, among others, Mr. Hosking's Egyptian Propylæum to the new cemetery at Abney Park; the Gothic church lately completed by Mr. Basevi, in Hans Place, Sloane Street, the Dorset County Hospital, now erecting after designs by Mr. Ferrey, and the mansion just commenced, we believe, by Mr. Blore, for Lord Francis Egerton, near Manchester; besides many other works which, even if of no particular merit in themselves, would afford information as to what is actually going on, but of which we seldom find more than a very small sprinkling at the Annual Exhibitions of the Academy. Even what subjects of this class we do meet with, are not always the best productions that might have been furnished; many of them, indeed, neither tasteful as designs, nor of interest as representations of buildings of any importance. This remark applies only in part to No. 968, "Entrance Lodge, as erected, West of London and Westminster Cemetery, at Earl's Court, Kensington," B. Baud; for the structure itself is of considerable extent, and of a kind affording scope for design, and for marked expression of character. As it is, it presents only a very tame composition of Roman Doric architecture, which is, besides, altogether marred by being filled in with windows that are equally at variance both with the style indicated by the order, and with what seems suitable for the particular occasion, inasmuch as they too strongly suggest the idea of a mere dwelling, not otherwise distinguished than by having an archway leading through it. For structures of this kind, and also for those intended for railway terminusses, some useful hints and studies, we may observe, are to be found in Sanmicheli's designs, for entrance gates and similar works, demanding mass and solidity, yet not rejecting architectural decoration.

No. 914. "Façade of the Wesleyan Centenary Hall, now building in the city of London," W. T. Pocock, is another drawing that shows a building of some magnitude now in execution. We cannot say that we greatly admire the design, either as we behold it here entire, or judging of it from the building itself, (in Bishopsgate Street,) as far as it is already advanced. On the contrary, we decidedly object to the basement, which has small arches, and is merely scored by a few horizontal stripes—a sort of apology for rustic joints—which produce a most harsh and disagreeable effect, where, instead of radiating towards the centres of the arches, they are cut off by the archivolts of the latter. We had hoped that the examples revived by Mr. Barry would, by this time, have fairly put every one out of conceit with that equally poor, monotonous, and unmeaning fashion, which certainly is not classical—neither Greek, Roman, nor Italian—nor has it anything whatever in it itself, to reconcile us to it as a desirable innovation. If the upper part of the façade satisfies us very little better, it certainly is not because ornament has been begrudged it, for it has large fluted attached columns, and pilasters of the Corinthian order, between which are two series of decorated windows (five on each floor), besides an attic or podium over the three middle intercolumns, surmounted in turn by a lofty lanthorn or turret copied from the well-known choragic monument of Lysicrates. For what particular purpose this last may be intended, we are wholly at a loss to conjecture, the purpose of the building itself seeming to require no such appendage, while, as regards the design, it might very well be spared, as the façade will be quite lofty enough without it. Of finery, indeed, there is enough and to spare, and we shall, therefore, probably hear the structure spoken of as a fine piece of architecture; but in vain do we look here for originality, for study, or for taste.

---

* We rejoice to have assurance afforded us by the letter from "A Protestant Architect," given at page 228, that the structures alluded to are so creditable to Mr. Pugin's taste and ability; but we think that the writer altogether overlooks a serious difficulty when he says, "it now remains for Protestant architects to display their zeal and their talents in a similar manner"; since neither the one nor the other can avail them much, so long as they are obliged to move in the shackles imposed upon them by the Church Commissioners, and by the pig-headed obstinacy of those who regard all originality of design, any abandonment of the barbarisms and the penuriousness displayed in our churches—of our squeezed up pews and piled up galleries, for the sake of architectural character and effect,—as scandalous and dangerous innovations, savouring of Popery and the Scarlet Lady with the title unmentionable. The regulations enforced by Church Commissioners are of themselves calculated to operate as a "wet blanket" upon all but mere plodders, who may even find their account in the proscription of aught approaching to originality. We fancy it would puzzle Pugin himself to produce much effect, were he similarly circumstanced, unless his ability be such that he could make a Quaker's meeting-house magnificent, without depriving it of its primitive plainness.

We are infinitely better satisfied with No. 921, which shows us—though not to particular advantage, the drawing itself being anything but an attractive one—the "Terminus of the London and Blackwall Railway," which has just been completed by Mr. Tite. It is a pleasing specimen of Italian architecture, simple in character, but free from the mock simplicity of poverty and baldness.

Nos. 1000 and 1001, the S.W. and N.W. fronts of "Roehampton Priory, Surrey," with the alterations and additions in progress, from the designs and under the direction of Gough and Romieu, exhibit a Gothic mansion of considerable extent, to which, we presume, the conservatories are the chief additions; but what may be the other alterations we know not, consequently cannot judge how far they have contributed to improve the building generally.

Though a small sepia drawing, and rather unfavourably hung, No. 983, "Bailiff's Cottage, recently erected at Chequers, Bucks, for Sir R. Frankland Russell, Bt.," E. B. Lamb, possesses great merit as a design, both in regard to character and picturesque effect, for it realizes the ideal of a cottage residence of that kind, and when it comes to be a little mellowed by time, will offer a pleasing study to the artist. We may also express our approbation of Mr. Walker's designs for the New Hospital or Almshouses at Bedworth, of which Nos. 1011 and 1014 afford us two perspective views. And we wish we could say as much in favour of No. 1067, "View of the Casino Promenade Concert Room, à la Musard, about to be erected on the east side of Leicester Square," S. Beazley; but our liking for it is so little, that we trust what the catalogue says will never be verified; or that if any building of the kind is to be erected there at all, it will be something totally different from such a Vauxhallish affair. For aught we know, Mr. Beazley may rival Vanbrugh as a dramatist, but as an architect, we do not think he is *quite* equal to him. In one sense, indeed, his buildings may very well be called *theatrical*, but *scenic*, they most assuredly are not; while in point of taste, they are the very antipodes of those of his predecessors, being as remarkable for flimsiness, as the others are for ponderous solidity.

Though we might point out several other designs, some for censure, and one or two for commendation, we must here conclude our notice of this year's exhibition, and look forward to a better one next season; as we may do with some degree of confidence, unless the present Decline is to terminate in a total Fall of the Academy's Architectural *Room*.

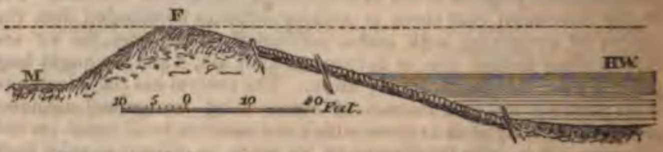
SEA EMBANKMENT.

THE work about to be described has lately been executed at the mouth of the Thames, near the entrance to the Medway, in the parish of St. Mary's, for the Right Honourable Lord de Vesci, who has an estate adjoining it.

The land bounding the sea at this place being marsh, and formerly covered with salt water every spring tide, was of very little value till it was embanked, which took place about two centuries back, and said to have been executed by a Dutch engineer, probably Vermuyden, who was in England about that time, having been engaged in similar works, of which was the embanking of the Dagenham marshes on the Essex side of the river, likewise the drainage of Hatfield Chase, near Doncaster, and he was afterwards employed in the Bedford Level. Considerable damage had been done to this wall at different periods, from the prevalence of north easterly winds, which are severely felt on this shore, the violence of the sea washing the stones from the slope and thereby causing breaches in the bank. The old wall was protected with stones and piles, but sufficient care had not been taken in the formation of the bank, otherwise breaches would not have so frequently taken place.

In the formation of the new wall, which is nearly three quarters of a mile in length, the old formed the necleus of the new work, the material for which was got by cutting on the land side a back delph which was kept to a regular section at about four yards from the foot of the back slope. The inclination of the back slope of the wall is 1¾ horizontal to 1 perpendicular, and that of the sea slope 4 horizontal to 1 perpendicular; the top of the wall is 3 feet in width, and raised 7 feet above high water of a spring tide, (Trinity datum). The bank was formed in regular courses about 12 inches in thickness, chopped and puddled to form a water-tight body; the face of the sea slope after being sufficiently consolidated, was covered with a thickness of four inches of concrete, and afterwards pitched with Kentish Wrag stone laid by hand, and rammed solid to a regular surface, the depth or thickness of the stone pitching varied from 10 to 12 inches, the stones being placed as closely as possible, and when the stones were not too large, placed with the largest dimension downwards to expose the least surface to the action of the water, and the joints filled in by wedging small pieces of stone into them by hand hammers. The surface of the paving was covered by an inch in thickness of fine gravel, which by the action of the water was washed into the interstices, so that the whole formed a solid and compact mass. From the regular slope of the sea side of this wall, and on account of its gradual rise, the waves meet with no abrupt impediment so injurious in works of this description, but on the contrary, spend themselves in running up the slope, thereby much lessening the effect of the concussion. The face of the sea slope above the stone pitching, and likewise the top of the wall was covered with a thickness of sand and shells, thus forming a footpath and preventing the heat of the sun from injuring the bank; the back or land slope was also properly trimmed and soiled or sown with grass seed.

The foot of the pitching is protected by a row of piling or stakes driven 6 to 7 feet into the ground, and 3 to 4 inches apart; and likewise protected on the sea side by a footing of stone and chalk, the refuse of the old wall, which has embedded itself in the foreshore, and thus forms quite a compact mass. There are also two rows of similar stake piling driven into the bank at the top of the slope, for the protection of the stone pitching; the following section will more fully explain the nature of the work.



M, marsh. F, footpath. H. W., high water Trinity Standard.

The novelty in the work is the introduction of concrete between the stone pitching and the clay substratum, by which the water is prevented soaking into the clay, and so wearing it away, and depriving the pitching of its support, from whence hollows necessarily arise, and shortly patches of stone pitching are removed by this gradual but sure process. In the event likewise of stones being displaced, the concrete prevents the evil spreading, forming itself a protection until the pitching be restored.

Breakwaters of stone encompassed with piling are constructed at the two most prominent points, to protect the wall from the sea during north-east gales, and likewise to encourage the accumulation of sand along the foot of the wall.

The work has been executed by Mr. Rowland, the contractor, of Strood, under the direction of Messrs. Walker and Burges; it was commenced during the latter end of 1838, and has been in progress with the exception of the winter months, till last April, when it was completed, so that during the greater part of that time, a principal portion of the work has been put to a fair trial.

GLASS PAINTING.

SIR—In consequence of the receipt of several letters since the publication of the brief remarks on the above subject, which appeared in the last number of your Journal, I am induced to mention, that I fully intend when leisure affords an opportunity, to endeavour to make that notice more complete, and that I shall be very glad therefore, to receive information concerning *any* glass-painter now, or lately practising in England,—his peculiarities, a list of his principal works, &c.

I am, Sir, your's,

Pelham Crescent, Brompton. GEO. GODWIN, JUN.

REPORT ON THE HARBOURS OF THE SOUTH EASTERN COAST.

We should have liked to have gone at some length into this report, but other matter, we cannot say more important, has prevented us. We may briefly characterize it as destitute of all principle, first proposing one principle, then another, then contradicting both, and but ill calculated to give satisfaction to the public or to men of science. Upon none of the great physical questions, the operations of which upon this coast have been the subject of so much controversy, does it give any elucidation, indeed it does not enter upon them. With regard to the numerous plans suggested for making harbours on these coasts, many of them ingenious, some good, and all entitled to attention, the commissioners pass them over with silent contempt.

Just to show the blowing hot and cold system which characterizes the proceedings of the commissioners with regard to the great principles at issue, we shall call attention to the following extracts from the last number of the Journal.

Margate.—"The power of sluicing at so great a distance as that proposed in this plan, could only be applied with advantage to a surface dry, or nearly so, at low water; and the idea of keeping a deep-water harbour of any useful width, clear by means of such sluicing, appears to us to be impracticable."

Ramsgate.—"There is no natural backwater so essential for the purpose of scouring."

Deal and Sandwich.—"The shingle is continually moving by the action of the waves, in the direction of the prevailing winds."

Dover.—"It should be observed that these sluices, though efficacious to a certain extent, are not capable of removing the obstruction altogether. The force of the water, which at its exit from the culverts is very great, loses its impetus as it spreads over a larger surface, and forces the shingle to a comparatively small distance, where it is liable to form banks beyond the power of the sluices."

Folkstone.—"A small stream is pent up at the north-west side of the harbour, for the purpose of scouring at low water; and with the assistance of manual labour, in addition to this very inadequate backwater, the channel is kept open so as to allow vessels of 10 to 12 feet draught to come alongside of the main pier at the top of high water." "In our opinion no scouring power would be able to keep the channels clear below the level of low water." "Constant motion of shingle."

Rye.—"Shingle accumulated by winds." "Powerful backwater thereby acquired, operated as a scour during the ebb, to clear the channel and keep the entrance open."

Hastings.—"There is no natural backwater, nor the facility of making an artificial one to any useful extent."

Newhaven.—"The river affords a powerful backwater for scouring the entrance."

Shoreham.—"A bar rises occasionally above the low water level, and shifts its position from 60 to 160 feet from the pier-heads."

Littlehampton.—"The backwater not enough."

These are *materials for thinking*, and we have no doubt will create some excitement among the advocates and opposers of backwater. We shall show, on a subsequent occasion, how beautifully this independence of attachment to principles is preserved in the plans of the commissioners themselves.

RETORT UPON RETORT.

Sir—Having myself animadverted in the first instance upon what Mr. Bartholomew had said of the new façade of the College of Surgeons, Lincoln's Inn Fields, which he is pleased to call both "ill-favoured" in itself, and not merely a cracking but "a *creaking* mass of fracture,"—it would ill-become me to complain of his animadverting upon me in return, in the preface to his "Specifications;" where he has introduced a long note, in which he says: "Mr. Leeds having with some coarseness of diction chosen to go out of his way in his '*Essay on Modern English Architecture*,' to comment upon my supposed admiration of the former façade of the College of Surgeons, I here tell him, that in this place as elsewhere, his quotations whether of the sense or words, are not accurate. I have put forth no such sentiment either by word or implication. I admired its portico as formerly existing, &c., &c."

Not being able at this moment to refer to the passage in question, I cannot pretend to be certain as to the precise words, yet whether so intended or not, the impression it left upon me was that Mr. Bartholomew considered the building to be altered greatly for the worse. That he admired the portico as formerly existing, the words I have quoted sufficiently prove; nor do I dispute his right to admire, more especially as there is scarcely any production of the present day which his taste will permit him to admire at all. He is now, it seems, however anxious to have it understood that he confined his admiration exclusively to the portico, by which I suppose he means merely the columns, for all that was behind them was most barbarous in design. But then by not protesting against the deformity of the other parts, and by again expressing his approbation of a portico, the interior of which was most detestable, he certainly does leave it to be inferred that he was not at all shocked at the architectural incongruities it presented. Very possibly he may have regarded with profound contempt and abhorrence all but the mere columns; still as he did not chose to make that clear to his readers, he ought not now to complain if he has been misunderstood, and his real meaning misrepresented.

With regard to the coarseness of diction which he lays to my charge, I allow that my expressions may have seemed coarse to one who is so guarded and refined in his own language, as to speak of modern architecture as being no better than a "fraudulent, pickpocket system," and of those who practice it, as ignorant pretenders and quacks, utterly ignorant of scientific principles of construction. The horrible coarseness of which I was guilty consisted in remarking; "after this, should any one obtain that writer's approbation or good words, he will have reason to consider it a most unfortunate symptom, and to take himself to task very strictly in order to ascertain what can have excited such ominous sympathy:" which no doubt sounds bearishly rude and indelicate to "ears polite," and in comparison with the delicate and dulcet, Mr. Bartholomew himself invariably employs.

Though he has done me the honour to single out myself, he might find, did he care to look about, other critics and other publications which have treated him with as little ceremony as he himself has treated his own brother-architects. By no means therefore am I a solitary offender; on the contrary, there are others still more *coarsely* blunt, and—what is perhaps worse, some who are still more keen.

W. H. L.

CLEGG AND SAMUDA'S ATMOSPHERIC RAILWAY.

With an Engraving, Plate XIV.

In our last number we gave some particulars regarding the first experiment, made on the Atmospheric Railway; we are now enabled through the kindness of the inventors to give drawings and descriptions of the railway and apparatus, together with some calculations.

In Clegg and Samuda's Atmospheric Railway, the power employed is the pressure of the atmosphere, brought into action by exhaustion. By reference to the plate, the following description of the apparatus will be rendered more clear:—

Fig. 1, is a general elevation of the railway, with a train of carriages passing over it.

Fig. 2, is a plan of the railway, with the upper surface of the pipe, at the part containing the entrance separating valve, removed to show its construction.

Fig. 3, is a longitudinal section of the railway, taken at the dotted line *m m* fig. 4, showing the connection between the piston and the train carriage and the method of lifting the continuous valve.

Fig. 4, is a transverse section of the same.

Fig. 5, is a transverse section of the pipe on an enlarged scale, showing the continuous valve and cover, and also the heater N, in dotted lines.

Fig. 6, a plan of the continuous valve on an enlarged scale.

The moving power is communicated to the train through a continuous pipe or main, A, laid between the rails, which is exhausted by air pumps worked by stationary steam engines, fixed on the road side, the distance between them varying from one to three miles, according to the nature and traffic of the road. A piston, B, which is introduced into this pipe, is attached to the leading carriage in each train, through a lateral opening, and is made to travel forward by means of the exhaustion created in front of it. The continuous pipe is fixed between the rails and bolted to the sleepers which carry them; the inside of the tube is unbored, but lined or coated with tallow $\frac{1}{10}$th of an inch thick, to equalize the surface and prevent any unnecessary friction from the passage of the travelling piston through it. Along the upper surface of the pipe is a continuous slit or groove about two inches wide. This groove is covered by a valve, G, extending the whole length of the railway, formed of a strip of leather rivetted between iron plates, as shown at fig. 5, the top plates being wider than the groove and serving to prevent the external air forcing the leather into the pipe when the vacuum is formed within it; and the lower plates fitting into the groove when the valve is shut, makes up the circle of the pipe, and prevents the air from passing the piston; one edge of this valve is securely held down by iron bars, No. 2, (fig. 5), fastened by screw bolts, No. 4, to a longitudinal rib cast on the pipe, and allows the leather between the plates and the bar to act as a hinge, similar to a common pump valve; the other edge of the valve falls into a groove which contains a composition of beeswax and tallow: this composition is solid at the temperature of the atmosphere, and becomes fluid when heated a few degrees above it. Over this valve is a protecting cover, I, which serves to preserve it from snow or rain, formed of thin plates of iron about five feet long hinged with leather, and the end of each plate underlaps the next in the direction of the piston's motion, thus ensuring the lifting of each in succession. To the underside of the first carriage in each train is attached the piston, B, and its appurtenances; a rod passing horizontally from the piston is attached to a connecting arm, C, about six feet behind the piston. This connecting arm passes through the continuous groove in the pipe, and being fixed to the carriage, imparts motion to the train as the tube becomes exhausted; to the piston rod are also attached four steel wheels, H H, (two in advance and two behind the connecting arm,) which serve to lift the valve, and form a space for the passage of the connecting arm, and also for the admission of air to the back of the piston; another steel wheel, D, is attached to the carriage, regulated by a spring, which serves to ensure the perfect closing of the valve, by running over the top plates immediately after the arm has passed. A copper tube or heater, N, about ten feet long, constantly kept hot by a small stove, Z, also fixed to the under side of the carriage, passes over and melts the surface of the composition (which has been broken by lifting the valve,) which upon cooling becomes solid, and hermetically seals the valve. Thus each train in passing leaves the pipe in a fit state to receive the next train.

The continuous pipe is divided into suitable sections (according to the respective distance of the fixed steam engines) by separating valves, *f* and Q, which are opened by the train as it goes along: these valves are so constructed that no stoppage or diminution of speed is necessary in passing from one section to another. The exit separating valve, Q, or that at the end of the section nearest to its steam engine, is opened by the compression of air in front of the piston, which necessarily takes place after it has passed the branch which communicates with the air-pump; the entrance separating valve, *f*, (that near the commencement of the next section of pipe,) is an equilibrium or balance valve, and opens immediately the piston has entered the pipe. The main pipe is put together with deep socket joints, in each of which an annular space is left about the middle of the packing, and filled with a semi-fluid: thus any possible leakage of air into the pipe is prevented.

From the result of the experiments already made, the inventors calculate that a main pipe of eighteen inches diameter will be sufficiently large for a traffic of 5,000 tons per day, viz., 2,500 tons in each direction, supposing the gradients of the road to average 1 in 100.

Note.—A main pipe, 18 inches diameter, will contain a piston of 254 inches area: the usual pressure on this piston, produced by exhausting the pipe, should be 8 lb. per square inch (as this is the most economical degree of vacuum to work at, and a large margin is left for obtaining higher vacuums to draw trains heavier than usual on emergencies)—a tractive force of 2,032 pounds is thus obtained, which will draw a train weighing 45 tons, at 30 miles per hour up an incline rising 1 in 100. Two and a half miles of this pipe will contain 23,324 cubic feet of air, $\frac{16}{30}$ of which, or 12,439 cubic feet, must be pumped out to effect a vacuum equal to 8 lb. per square inch; the air pump for this purpose should be 5 feet 7 in. diameter, or 24·7 feet area, and its piston should move through 220 feet per minute, thus discharging at the rate of 24·7 × 220 = 5,434 cubic feet per minute at first, and at the rate of 2,536 cubic feet per minute when the vacuum has advanced to 16 inches mercury, or 8 lb. per square inch, the mean quantity discharged being thus 3,985 feet per minute; therefore $\frac{12439}{3985} = 3·1$ minutes, the time required to exhaust the pipe; and as the area of the pump piston is 14 times as great as that in the pipe, so the velocity of the latter will be 14 times as great as that of the former, or 220 feet per minute × 14 = 3,080 feet per minute, or 35 miles per hour: but in consequence of the imperfect action of an air-pump, slight leakages, &c., this velocity will be reduced to 30 miles per hour, and the time requisite to make the vacuum increased to 4 minutes: the train will thus move over the 2½ miles section in 5 minutes, and it can be prepared for the next train in 4 minutes more, together 9 minutes; 15 minutes is therefore ample time to allow between each train, and supposing the working day to consist of 14 hours, 56 trains can be started in each direction or 2,520 tons, making a total of 5,000 tons per day. The fixed engine to perform this duty will be 110 horses power, equivalent to 22 horses power per mile in each direction.

The next item to be considered is the comparative cost of the two systems.

1st. The necessity of having the railway comparatively level, causes the present enormous outlay for earth-work, viaducts and tunnelling: it also increases the cost of land, not only by lengthening the line to save cutting and embankment, by the quantity wasted on each side of the road wherever an embankment or cutting is required. Thus if an embankment or cutting has to be made of thirty feet, at least sixty feet of land must be covered on each side of the railway in order to obtain sufficient slope, making a width of 120 feet, besides the road, except where they occur in stone oı chalk. The comparative expense of this item between the two systems can be ascertained by referring to the average cost of forming a turnpike road and that of the principal railways now in operation.*

LOCOMOTIVE SYSTEM.

	Per mile.
Taking five of the principal Railroads as the basis of the calculation, their average expense of formation has exceeded	£36,000
And the original stock of Locomotives	1,600
	£37,600

ATMOSPHERIC SYSTEM.

	Per mile.
The average expense of forming a turnpike road throughout England has been 3,000 per mile, but for the atmospheric railroad, say	£4,000
Allow extra for road-bridges	2,000
Rails, chairs, sleepers, and laying down	2,500
Main pipe and apparatus complete (on a scale for transporting 360 tons per hour, or 5,000 tons per day of fourteen hours, on a road with gradients of 1 in 100)	5,200
Fixed engines, air pumps, and engine-houses	1,400
Travelling pistons	20
	£15,120
Saving per mile in forming and furnishing on the Atmospheric system	22,480
	£37,600

Annual expenses of working per mile, when conveying *two thousand tons* per day. (This is beyond the average quantity conveyed on the Liverpool and Manchester Railroad):—

LOCOMOTIVE SYSTEM.

	Per mile.
5 per cent. interest on capital sunk £37,600	£1,880
Maintenance of way	450
Locomotive department, including coke	1,800
	£4,130

ATMOSPHERIC SYSTEM.

	Per mile.
5 per cent. interest on capital sunk, viz., £15,120	£756
Maintenance of way, and attendance on mains	300
Wear and tear of fixed engines, 5 per cent. of cost	70
Coal ·75 lb. per ton per mile, 214 tons, at 20s.	214
Wages to engine men and stokers	60
Wages to train conductors	26
Renewal of travelling apparatus and composition, and sundries	200
	£1,626
Annual saving per mile on the Atmospheric system	2,504
	£4,130

Total expenses per ton per mile on the Locomotive system 1·54 pence.
Ditto ditto ditto on the Atmospheric ditto 0·6 do.

Exclusive of carriages and management, which may be taken as the same on both systems.

From the above description, and the calculations made by the ingenious inventors, together with the success of the experiments which have been made, almost daily, for the last month, our readers will be able to form some judgment as to the probable introduction of this new system into general use; we sincerely hope that the inventors will be able to obtain an ample reward for the great expence and labour they have devoted to the first experiment, which has, to say the least of it, been carried out by them in a very spirited manner.

---

* The calculations are founded on the reports of different companies whose railways are complete or in a forward state.

CORRECTION—CANDIDUS.

Allow me, Sir, to correct an error in Fasciculus, No. 16, by your Correspondent Candidus, in last month's Journal, he there states that the Medal was given by the Institute to the late Sir J. Soane. The Medal was by public subscription, as doubtless you remember.

A.

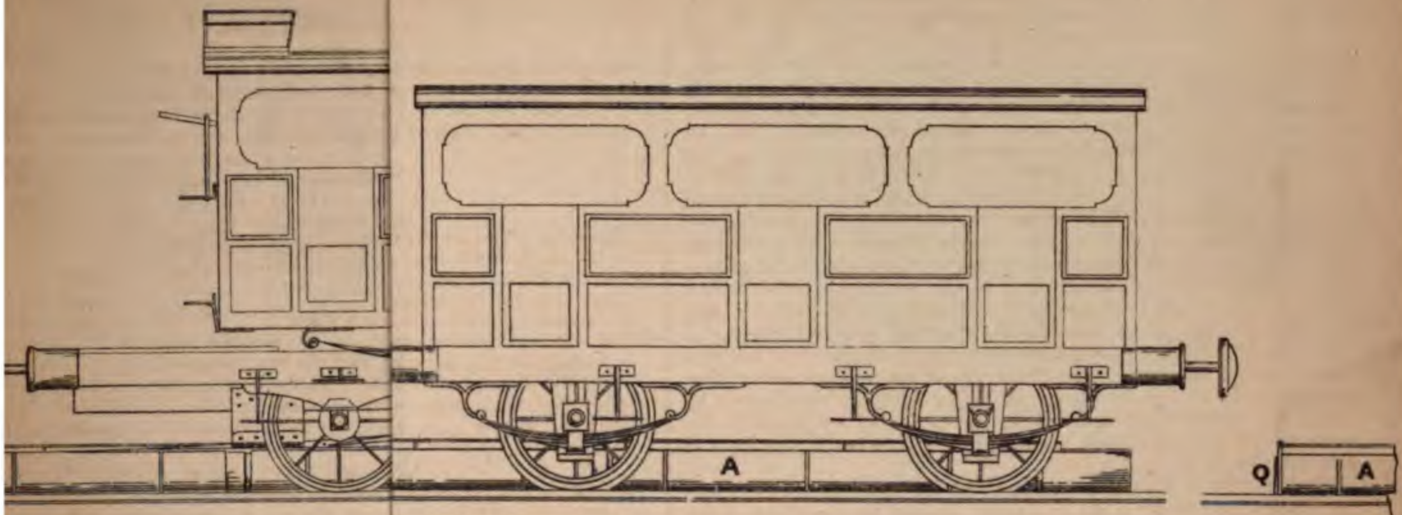
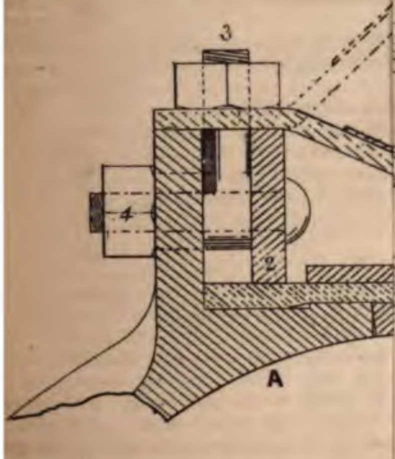
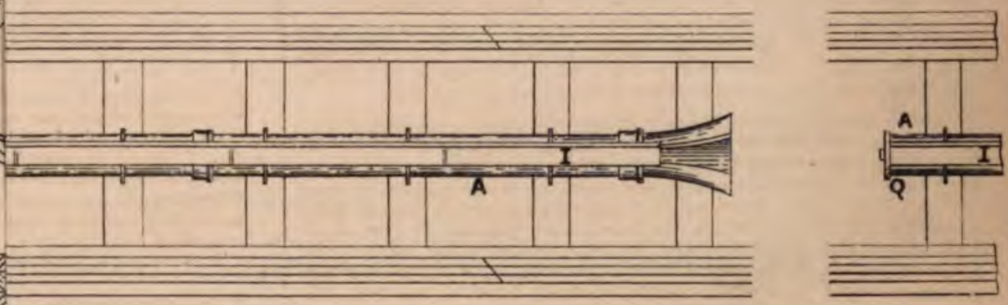


FIG 5.





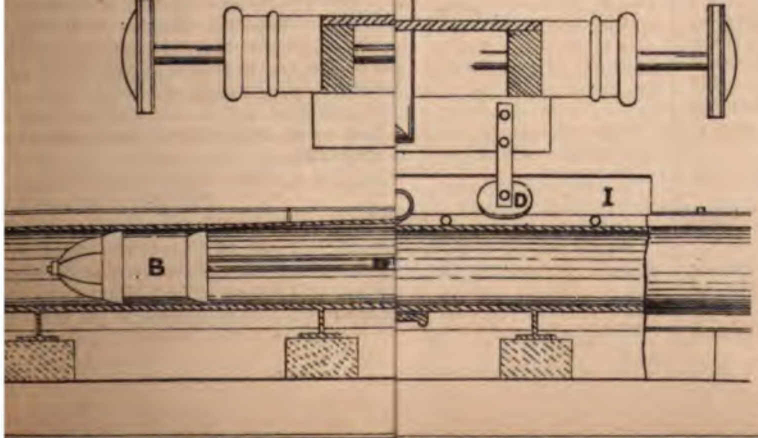
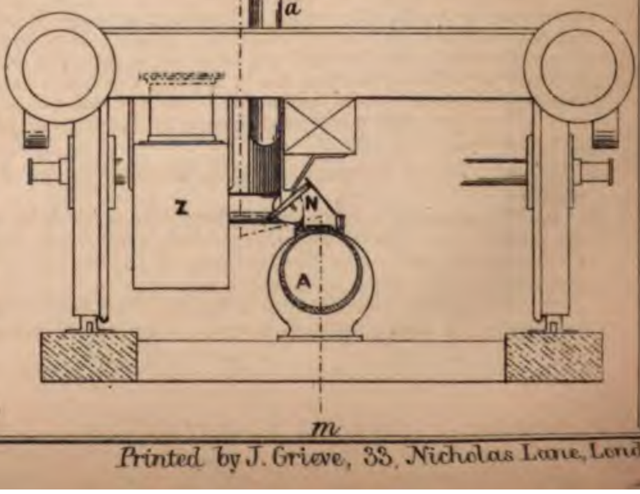


FIG. 4



Drawn on Zinc by J. C. Had

Printed by J. Grieve, 33, Nicholas Lane, Londo dering it fluid, which, upon again cooling, becomes solid and hermetically seals the valve. Thus each train, in passing, leaves the pipe and valve in a fit state to receive the next train.

For the purpose of exhausting the tube a steam engine of 16 horse power is employed, which works an air-pump or exhauster 37½ inches diameter, and 22½ inches stroke, making from 40 to 43 strokes per minute. The air-pump is connected with the exhaust tube in the centre of the railway, by means of a branch pipe 9 inches diameter leading from the air-pump.

To calculate the power of this kind of apparatus, it is nescessary to ascertain the state of vacuum and the difference of the pressure of the atmosphere which forces the piston forward; in the present experiments the vacuum was equivalent to from 18 to 20 inches of mercury, which will give for the useful pressure of the atmosphere on the piston about 9 lb. on the square inch. The area of the tube, 9 inches diameter, is equal to 63·62 square inches, and this multiplied by the pressure, will give

$$9 \times 63{\cdot}62 = 572{\cdot}58 \text{ lbs.}$$

for the pressure on the back of the piston, or the moving power.

The load conveyed at each experiment may be taken as follows:—

Two carriages........................ = 4 tons.
Apparatus attached .... = 1 ton.
Forty-five passengers .... = 3 tons.

Total load conveyed .... = 8 tons.

The stationary engines and air pumps on this system may be fixed in distances varying from one to four miles apart, to suit the traffic and convenience of the line of road; each section or length of pipe acted on by one engine is confined between two valves; the vacuum is created to about 18 to 20 inches of mercury before the piston enters the pipe, and is maintained during the passing of the train by the engine being kept at work; having passed through one section of pipe, the momentum the train has attained, serves to carry it on to the next section, which commences at about 100 or 200 yards beyond, and the entrance separating valve of the second section being opened by the carriage immediately after it has entered, allows the vacuum prepaced in this section to act upon the piston; thus the train can pass from section to section without end, and without any stoppage.

Experiments.—For the purpose of ascertaining the relative velocity on various portions of the half mile, it was divided into 20 sections of 2 chains or 44 yards each. The carriages were started from a state of rest at the foot of the inclined plane of one in 120, and allowed to run up the incline of half a mile before the break was applied to arrest the progress of the carriages. When two carriages were attached, they run over the ground, after passing the first 5 divisions at the velocities of 7, 6, 5, and 4 seconds to each section, which is equivalent to 13, 15, 18, and 22½ miles per hour; and when *one* carriage only was attached, it run over the ground at the velocities of 6, 5, 4, and 3 seconds to each division, which is equivalent to 15, 18, 22½, and 30 miles per hour. The last division in each experiment was done at the greatest velocity, which clearly shows that had the experiment been made on a mile run instead of a half mile, the experiment would have been far more favourable and satisfactory; and if the experiment had been made on a level, about four times the above load might have been conveyed at the same velocity.

We noticed that it took about 1½ minute to raise the vacuum each trip, to about 18 inches of mercury.

From the above experiments, the loads drawn, and the speed attained, will be as good a criterion of the success of the undertaking at we can have, and when we consider that in producing these results, the patentees must have been wholly unassisted by any previous examples, we think that the greatest credit is due to the talent and ingenuity they have displayed. The system appears to us to possess many advantages which must insure it the serious consideration of the engineer. The carriages travel without noise, and without the risk of explosion, or of getting off the rail. It does not seem possible that a collision of trains can take place, for two trains cannot receive power from the same section of pipe at the same time, neither can they receive power in opposite directions on the same rail. The speed on this system must be proportioned to the capacity of the air-pumps used to maintain the exhaustion in the tubes, and therefore any rate of travelling that may be deemed desirable may be easily attained.

French Railways.—The Railway Committee held another meeting last week in Paris, and after hearing parties interested in the five companies affected by the Government bill, took into special consideration that part of the measure which relates to the lines from Lille and Valenciennes to the Belgian frontiers. The Committee approved of these two lines being executed by Government, not only on account of precautions that might be rendered necessary by the defence of the frontier; but also because the formation of treaties with Belgium might render it desirable that these lines should be in the hands of the State. The Committee was of opinion that the termination of these lines was the more called for, since the Belgian lines to the frontier were already executed. The line from Lille to the frontier near Mouscron is 14,125 meters in length, or 47,000 English feet; and that from Valenciennes to the frontier near Quievrain is 63,128 metres, or 43,000 feet; the first is to cost 1,000,000f., the latter 4,000,000f. The Committee adopted this part of the bill almost unanimously, as also the lines and surveys as approved of by the administration of the Ponts et Chaussees.—*Railway Times.*

Llanelly Railway.—The present state of the new line is as follows:—From the Dock at Llanelly to Parkrhyn (main line) eleven miles, and from thence up to the terminus of Cwm Amman branch, six miles, altogether seventeen miles, the line has been completed and open for traffic, over which the locomotive engines of the Company are travelling.—From that point, viz. Parkrhyn, up to Duffryn Lodge (about a mile and a half further on the main line) the same is nearly completed, the rails having been laid, and the filling in in progress.—From that point on the main line, viz., Duffryn Lodge, the branch leading to Mr. Long Wrey's collieries, and Messrs. Morris, Sayce, and Co.'s, is in course of forward progress, and will be completed by 1st January next, this branch is altogether about four miles in length, and leads to several collieries of capital coal. The Company have entered into a contract with Mr. Wrey, to bring for seven years at least 10,000 tons yearly down this branch, which will yield railway and dock dues, as a minimum amount, the sum of 1,000*l.* per annum—The two new locomotive engines to which reference was made in the last annual Report as then ordered, are now at Llanelly, and one of them, the *Albert*, is engaged in traversing the line, in hauling coal down to Llanelly. The Committee are persuaded that the carrying trade which will thus be secured to them by locomotive power, will be a source of profit when the quantity of coal, iron, &c., shall be increased: whilst as an auxiliary to the general traffic the use of steam power is unquestionably of great importance.—*Directors Report.*

Preston and Wyre Railway.—The Directors have made an arrangement for one year with the North Union Railway to supply this Company with locomotive engines at 2*s.* 4*d.* per mile per train. and with the first-class carriages at a penny per mile each, and with second-class at a halfpenny per mile each. This will prevent the present outlay of a considerable capital, a circumstance particularly desirable until the extent of the traffic on the line has been ascertained.

Great North of England Railway.—The works of the Great North of England Railway between York and Darlington, are in so forward a state, that the Directors of the Company have employed Mr. Green, of Darlington, architect, to furnish designs for depôts upon the line.—*Leeds Intelligencer, May* 30.

The Cheltenham Railways.—Within the last few days the bank which separated the Birmingham and Gloucester works from the Cheltenham and Great Western, between the station and Lansdown Bridge, has been cut through, from which circumstance we should infer that a satisfactory arrangement has been entered into by the two Companies. The greatest exertions are making to complete the work up to the Lansdown bridge, and from the number of hands employed, and the activity displayed, we should fancy that a very short space of time will suffice for the attainment of that object.—*Cheltenham Journal.*

Locomotive Carriage.—Mr. Hills lately made a very successful trip to and from Camberwell and Brighton with his patent locomotive carriage, the distance from Camberwell to Brighton was performed in 5 hours and 10 minutes, out of which time one hour 21 minutes was lost by delays in obtaining a supply of water at the inns, and 10 minutes delay on the road. The return trip was accomplished in 5 hours 22 minutes, out of which time one hour four minutes was lost by delays in obtaining water, and 26 minutes delay by stoppages on the road; the delays in obtaining water will be reduced very considerably, when proper stations and stated periods for arrival are made, the whole of the stoppages need not occupy more than 12 minutes, which, according to the speed the carriage ran on the road, the journey from London to Brighton might be very well accomplished in about three hours and a half. Our correspondent, who accompanied Mr. Hill on his trip to London, states that the form of the carriage is a handsome britzka, that there is scarcely any noise from the working of the engine, or escape of steam, and no appearance of smoke; on descending hills it is easily regulated by powerful retarders, and guided with the greatest facility. We hope at some future time to be able to give some additional information connected with the cost of a carriage, and the working of the same.

NEW CHURCHES, &c

Plymouth.—On Tuesday 20th May the foundation stone was laid of a new Church in Southside-street, in this borough, and which is to be called "Trinity Church." From the peculiar circumstances of its locality, it differs greatly from the usual form of New Churches. Its interior may be described as a square of about 70 feet, divided into three parts by two parallel Tuscan colonnades, each surmounted by an attic range of semicircular windows, forming a *clerestory* as in our cathedral churches. The traverse section of the building, therefore, exhibits a nave of about 35 feet high, by 37 feet wide, and two aisles, each about 25 feet high, by 16 feet wide, the galleries being constructed along the latter. The building being surrounded by houses, &c. on the north, south, and west sides, the only light, in addition to that of the clerestories, is derived from three windows at the east end, the central one being a large three-light Venetian window over the altar, which terminates a recess extending about 14 feet eastward from the main body of the church; on each side of the altar projection is an entrance porch; and there is a third porch in the centre of the north side to afford an entrance from Southside-street. The bell turret, surmounting a pediment over the great east window, is in the simple form of an arch flanked by pilasters, and crowned with a small pediment, a repetition of the larger one below. It is anticipated that the perspective of the interior looking from the western end will be boldly picturesque and ecclesiastical; that the effect of the lofty clerestories will be not less striking, than novel, as a modern application of Italian architecture; and that the altar-piece, with its triple Venetian window over, will form an imposing termination to the vista. The church is calculated to afford accommodation for about 1100 sittings, of which 650 are free. George Wightwick, Esq., is the architect.

Northamptonshire.—The Hon. H. Watson, brother of Lord Sondes, with praiseworthy munificence, intends erecting a new church at Guilsborough, entirely at his own expense. The cost of the building, it is said, will amount to upwards of 5,000*l.*

AN ESSAY

ON ORIGINAL COMPOSITION IN ARCHITECTURE, AS ILLUSTRATED IN THE WORKS OF SIR JOHN VANBURGH.

By James Thomson, Fellow.

(Read at the Royal Institute of British Architects.)

Sir,

I should feel bound to apologize for submitting any observations of mine to your notice, had they not been written in compliance with that general request which the council have made from time to time to every member of the Institute, viz., that each should in his turn contribute (though it be but a grain of information) touching the art which it is our business, and our pleasure, to pursue.

From the time that I have been able to trace the relation of cause and effect in architectural composition, it has appeared to me that "there is more in it, than is commonly dreamed of, in our philosophy"; or if dreamed of, that we want more general interpreters; not so much for the instruction of the professional student, or practitioner, as for the public mind, so that it may be known to all the world, in very deed and truth, to be a fine and liberal art. To be an art, on the one hand, dependant upon the observance of fixed principles, however variable the practice that arises out of them; and on the other, to inculcate a right apprehension of the impossibility to produce a work of any lively interest by mere attention to what are termed "the rules of architecture."

These rules in architecture I consider to stand in the place of grammar in a language, the due observance of which is as necessary to the one as the other.

We know very well that an author, to be lucid and comprehensive, must duly attend to all the relations of words and sentences, and that, without it, the most vigorous imagination will produce but a jargon of execrable nonsense; but on the other hand, I am sure you will agree that the utmost attention to the arrangement of thesis and antithesis, of versification or prose, (where the master mind is wanting,) will fail to realize a work of importance, even though the theme be one, of which but the mention, would awaken the liveliest anticipations. Just so in architecture, be the subject great or humble—the rules of composition must be duly observed to avoid incongruity, although they should but subserve to the development of works designed to possess contemplative interest.

And respecting this grammar of architecture, I would here observe that, except for Roman or Italian structures, we possess at present scarce any grammar at all! in those styles we have, from Vitruvius down to Chambers, so much to guide us in proportion and detail, that it is scarcely possible to err in them; but although we have *examples*, many, and valuable, in Greek and Gothic architecture, we have hardly any *principles*, set forth respecting them, to say nothing of Egyptian, Hindoo, and other Eastern styles, which, though they be but as dead languages to us, yet possess, like their language, deep soundings of the principles of art and science.

Now when we consider by what different means the end has been accomplished of giving importance and beauty to public and private erections, each amenable to certain laws that belong, not to an arbitrary set of forms and features, but to the workings of the human mind to which they have corresponding influence, I submit that it is to these laws that we should give peculiar attention, calculated as they are to guide, but not to fetter, the free will of the architect. For instance: in the ponderous masses of the Hindoo and Egyptian, the mind rests as complacently as on those of other climes; it is addressed and responded to in a particular way;—in the grace and simplicity of the Greeks, it is captivated in another;—in the harmonious combination of the Italians, it is equally (though differently) charmed and delighted: and so of the rest.

It is then I would submit the object of the architect, in an abstract sense, so to combine the masses and subdivisions of a building as to address themselves not merely to the eye, but to the imagination—that the subject, be what it may, shall vibrate some string of the mental frame as distinctly and tangibly as poetry or painting.

On this account it has appeared to me that it would be highly valuable, if we had set forth some chart of the vast region which lies before us, and which, if not sufficiently detailed to point out all that could be done, might indicate with sufficient precision, the rocks of offence to be avoided.

Thus it is obvious that a *Theatre*, and a *Mausoleum* should be very differently treated, even though they were to be in the same style of architecture—that the one could scarcely be too lively in its general character, and the other scarcely too broad and simple. That in the former every animation that form and colour combined could produce might be adopted,—while in the latter that simplicity and repose should prevail, so as to prepare the mind for the not less pleasing sympathies, which commonly associate themselves with the memorials of departed worth.

Again, it must be evident that a *Temple* for public worship should maintain a very different character to that of an *Exchange*, or hall of commercial festivity, and that apart from the mere internal fittings, it should outwardly bear some evidence of the purposes to which it is devoted.

Yet so little has this been attended to, that without particularizing any, I am sure it will occur to most whom I have the honour to address, that there are instances of which, if we had no previous knowledge, we could not possibly divine for what purpose they were erected. So far as to character of buildings, according with their objects. But now with reference to *style*.

I think Sir, it is to be lamented that we have at this period no *prevailing style* by which buildings of the present age, will be able in after times to be identified, and that in but few of them does there appear any recognition of the leading principles which seem to have governed the ancients. There is, in our own day a continual struggle in the adaptations of features at variance with the main object. The private individual demands novelty, and the judgment of the architect is too often called upon to bend to, instead of directing the work, from this—confusion has resulted in the public mind as to what is good or bad; and to this confusion I would ascribe the indifference which, it is to be regretted, has superinduced on the subject.

Thus we have at one and the same period of time, springing up in all quarters, and frequently in the same quarter, buildings of every era and of every style on the globe. So that they will with respect to date completely "puzzle posterity."

I do not of course include in my observations those restorations or rebuilding of ancient structures, by which are preserved for after ages the examples we ourselves so greatly admire, and with the perpetuation of which it must be a proud event to any architect to connect his name. I mean simply to allude to the practice we have of building in ancient styles for modern objects. And Sir, I would ask why should this be the case? seeing it is fraught with inconvenience at the present—confusion hereafter—and at variance with good taste at all times. It cannot be said that we have no other means, for we have seen that the means are so various, it would be only difficult to fix their limit, and as it was eloquently expressed, by a distinguished individual, not long since on the subject of general design—"Sources that can never be exhausted while the mind of man can conceive, or the hand transfix and embody the conceptions of the mind."

In the east we have characters so expressive that there is no possibility of mistaking their origin or their application. The solemn dignity of the Egyptian temples, pyramids, and obelisks, are totally different from those of the Hindoo, although both possess great boldness of outline and massive proportions. The prevalence of the pyre-like forms in the one, and the square or cubical parts of the other, produce in the mind varying though equally imposing effects.

So in the south—the simplicity and grace of the Greek temples, composed of columns and entablatures, totally distinct from the eastern, affect us by their peculiar and harmonious proportions.

Again, the Romans, borrowing it is true, the column and entablature of the Greeks, yet so resolved them into other proportions (making the front as well as the whole partake of the change), that by another avenue to the human mind, they yield to the imagination another, and a new delight.

They reduced the diameter of the columns and depth of entablature, widened the intercolumniations, and divided their buildings into separate stories; adapting them to the habits and pursuits of another people and another age. They retained the continuous and horizontal lines of the Greeks, but they traversed them by vertical ones, and by the introduction of the arch, they wove us in the loom of science a new and beautiful fabric.

Now let us consider another class of architecture, in which neither the pyramidal form of the Egyptians, nor the massive pillars of Hindoostan, nor the column and entablature of the Greeks, nor the arch of the Romans are at all, or materially discernible, yet while it adapts itself to almost every occupation of life, is calculated to affect the mind perhaps more deeply than all the rest.

I need hardly say to *you*, gentlemen, that I allude to Gothic architecture; or even to the non-professional to do more than mention it, but there springs up at once from the recesses of the memory the most vivid impressions of its venerable features. Of clustered pillars and intersecting arches, giving a kind of endless perspective to the nave and aisle of our cathedrals, and cloisters of our colleges.

Of capitals that appear to flourish with the more luxuriance because freed from the trammels of attic stringing.

Of spires and pinnacles, studded with crotchets, that by their gradual diminution seem to elude the sight.

Of massive buttresses that like giant champions arrange themselves with sturdy strength to protect the pile from the assaults of time or elemental strife.

And of windows. Oh! did we ever have windows before? Loop-holes indeed we had, and an admirable frame-work surrounded them; but the windows of Gothic structures are high and wide enough to be supposed of diviner origin, designed to let in, and to diffuse the rays of heaven.

But then again, let us dwell for a moment on the "ever varying, ever new" changes which have been rung on this style, in the production of the Tudor arch as distinguished from the pointed, and both in their difference from the Saxon; let us also notice what appropriate "keeping" (as painters would term it) attended these different changes in the details of mouldings and enrichments; how abrupt and bold are the lozenge, zig-zag, and chevron, as the style to which they belong, and how flowing and graceful is the tracery of the apertures, canopied niches, and finials of the others.

But, Sir, I come now to speak more particularly to the subject which has induced these prefatory remarks, necessary, they appeared to me to be, though possibly too lengthy to you, they have been made in the attempt to show that in availing ourselves of the productions of art from the earliest times to the present, and of all countries; we should duly and carefully *Anglicize* the materials we so obtain, and that we should indeed make them *our own*, not by the mere plagiary of the works of our predecessors, whereby we abuse the talents which they have bequeathed us in adapting them to purpose for which they have no affinity! but that we should so study and trace the principles which guided them, as to work out, a legitimate and definite style for ourselves. In illustration of these remarks I purpose as a noble example to consider the peculiar style and character of Sir John Vanburgh.

I believe, Sir, I shall not be saying too much when I assert that he studied the characteristics of architecture of the whole eastern hemisphere, and that while his resources extended from the Nile to the Netherlands, be followed not any beaten track, but struck out for himself a new style and character of building which he not only adapted to the habits of English life, but so grouped the *subordinate* with the *stately* features—that as examples of domestic architecture he has produced some of the noblest piles of which our country can boast. To examine this style, to analyze its principles, is my present object, not, be it remarked for the purpose of recommending its adoption, no, but for that of illustrating the course which in my humble opinion he has shown us we should pursue. And which those who have had the gift and perseverance to pursue have invariably made for themselves a fame which (during life indeed) may be unattended with any corresponding celebrity; but to whose productions after ages will refer (as in our days the more ancient are), for the guidance of the student and admiration of the world.

I had intended here to allude to the works of some of the architects of our own day, as possessing more decided originality than most of us can lay claim to, but as this might seem adulatory on the one hand, and invidious on the other, I prefer to avoid it.

And now to come more closely to the style of Sir John Vanburgh. I have chosen the princely mansions of Blenheim and Castle Howard.

And first of Blenheim. It certainly is not Roman, though it has much affinity to Roman, but the intercolumniations are too close and divide the masses into proportions not often recognizable in the works of the Italian architects, besides which there is less variety and subdivisions of detail; it is therefore not strictly Roman.

It certainly is not Grecian. Yet how few compositions are there professing to be Greek which retains such continuity of line and quantity. The superior cornices range with each other, and the inferior are made to follow as a string course which binds the whole, simply and compactly together—still it is not Grecian.

It certainly is not Gothic, but it possesses (I submit) many of the qualities of Gothic—the frequency of the pillars and piers, break up the horizontal lines, not as in the Italian buildings where pillars are used with entablatures breaking round them, but continuing up and surmounting them with terminal-like decorations.

I might go further and allude to that other Italian style,—to the consideration of which the Institute was lately called by a paper favoured them by Sir Gardnor Wilkinson; one, that for the matter it contained, and the discussion it produced amongst the senior members as to its origin, was perhaps one of the most interesting of the present session. Here, however, was another style differing not in mere details, but in the main principles of compositions.

A broad and simple façade, unbroken by proportions either as to plan or decoration. A total absence of columns as a part of the superior building, but used subordinately for the decorations of the apertures—these apertures placed one above another in perpendicular lines by their uniform size preserved also the horizontal ones. And at the summit a *cornice* that for boldness of outline and richness of detail, casts into utter insignificance all former pretensions to it. And while it *really protects*, most *magnificently adorns*.

But even these, or all these, did not lead captive, they but excited the energies of Sir John Vanburgh.

Secondly, of Castle Howard.*

Now I think it is universally agreed that there is about this façade something strikingly simple, majestic, and harmonious, and as I have before said of Blenheim, neither Roman, Greek, or Gothic, yet possessing much of the characteristic of each.

The great excellence, however, which belongs to it is, that while all these styles are as I have said to be recognized, they are not crudely combined, but while the principles of each appear to have been fully perceived and understood by Sir John Vanburgh, he suffered them to pass as it were through the alembic of his mind, and bring into existence *a new combination*.

I have said, it is not Roman, though it possess Roman features—its moldings, its arches, are certainly of Roman origin, but with what simplicity are they here arranged.

If you compare it with the earlier or later masters of the Italian school, you will find that where the column and pilaster were introduced as parts of the main building, they were broken and unequal in their parts. That Palladio himself in most instances divided the height of the building into separate stories; piling up order above order; but with a felicity (it is true) that has ever since, and ever will command universal praise. Such also is the case with the palaces and basilica of Scammozi and San Michell as seen at Verona, Vicenza, and Venice.

They are all, or nearly so, divided into separate stories, which at once involves a distribution of other parts, essentially differing from the practice afterwards pursued by Sir John Vanburgh.

Neither does the colossal aspect of these buildings depend upon their size. They arise as I have before intimated, but in other words, upon that philosophical arrangement of *substance* and *void*, of *ordinate* and *subordinate* parts, that while each possesses its due interest, it becomes but an integral part of a sublime and beautiful whole.

Thus then did Sir John Vanburgh proceed—in the grand features, borrowing simplicity and breadth from the practice pursued from the Greeks, and, in the details, from the more tractable forms of Italian art he produced those stupendous works which are now visited and admired by persons of every rank and degree.

The rude and uncultivated mind finds something, (it knows not what), which impresses a kind of awe, while the poet and the painter, whose occupation and aim it is, to engage our finer sympathies, each have the principles of their own art expressed in another way.

Gentlemen, I have thus endeavoured to point out the principles of architectural composition as illustrated in the works of Sir John Vanburgh.

That it might have been much better done, I am fully aware; but inasmuch as the ground has not to my knowledge been trodden before,—inasmuch as that I could find no published work to assist me,—inasmuch as our Institute has been founded not only for imparting statistical information, but for the mutual interchange of professional thought and sentiment. I have ventured to offer you mine on this subject.

And as men commonly make an exchange *to benefit themselves*, I shall hope and trust some abler hand than mine may be induced to dilate upon it, more equal to its merit, so that from this small beginning now, we may all at a future period reap a *sterling, and lasting advantage.*

James Thomson.

June, 1840.

---

* Here were exhibited by Mr. Thompson the series of drawings illustrative of the subject of his essay, engravings of which we are sorry to omit, but have been obliged to do so on account of their extent, and the prescribed limits of our Journal.—Ed. C. E. & A. Jour.

Antiquity of Railways and Gas.—Railways were used in Northumberland in 1633, and Lord Keeper North mentions them in 1671 in his journey to this country. A Mr. Spedding, coal agent to Lord Lonsdale, at Whitehaven, in 1765, had the gas from his Lordship's coal-pits conveyed by pipes into his office, for the purpose of lighting it, and proposed to the magistrates of Whitehaven to convey the gas by pipes through the streets to light the town, which they refused.—*Carlisle Journal.*

PUBLIC BUILDINGS IN LONDON.

A Critical Review of the Public Buildings, Statues and Ornaments in and about London and Westminster—1734.

By Ralph.

(Continued from page 228.)

From the terrace of Lincoln's Inn Gardens, we have a prospect of one of the largest squares in Europe; it was originally laid out by the masterly hand of Inigo Jones, and intended to have been built all in the same stile and taste: but by the miscarriage of this, and many other such noble designs, there is too much reason to believe that England will never be able to produce people of taste enough to be of the same mind, or unite their sentiments for the public ornament and reputation. Several of the original houses still remain to be a reproach to the rest, and I wish the disadvantageous comparison had been a warning to others to have avoided the like mistake.

Great Queen Street is another instance of our national want of taste; on one side is a row of houses that Italy itself would not be ashamed of; on the other, all the variety of deformations that could be contrived as a foil to beauty, and the opposite of taste.

Covent Garden would have been, beyond dispute, one of the finest squares in the universe, if finished on the plan that Inigo Jones first designed for it; but even this was neglected too, and if he deserves the praise of the design, we very justly incur the censure for wanting spirit to put it in execution. The piazza is grand and noble, and the superstructure it supports, light and elegant.

The church here is, without a rival, one of the most perfect pieces of architecture that the art of man can produce; nothing can possibly be imagined more simple, and yet magnificence itself can hardly give greater pleasure: this is a strong proof of the force of harmony and proportion, and at the same time a demonstration that it is taste, and not expence which is the parent of beauty: if this building can be said to have any defect, it is in the form and manner of the windows, which are not only in a bad gusto, but out of proportion too.

Leicester Square has nothing remarkable in it, but the inclosure in the middle, which alone affords the inhabitants round about it something like the prospect of a garden, and preserves it from the rudeness of the populace too.

The portico to St. Martin's Church is at once elegant and august, and the steeple above it ought to be considered as one of the most tolerable in town; if the steps arising from the street to the front could have been made regular, and on a line from end to end, it would have given it a very considerable grace; but as the situation of the ground would not allow it, this is to be esteemed rather a misfortune than a fault. The round columns, at each angle of the church, are very well conceived, and have a very fine effect in the profile of the building; the east end is remarkably elegant, and very justly challenges a particular applause. In short, if there is any thing wanting in this fabric, it is a little more elevation, which I presume is apparently wanted within, and would create an additional beauty without. I cannot help thinking, too, that, in complaisance to the galleries, the architect has reversed the order of the windows, it being always usual to have the large ones nearest the eye, and the small by way of attic story on the top.

St. James's Square has an appearance of grandeur superior to any other plan in town, and yet there is not any one elegant house in it, and the side next Pall Mall is scandalously rude and irregular.

St. James's Church is finely situated, with regard to the prospect on the north side of the square; and if it had been built in suitable taste, would have appeared most nobly to fill the vista, and add a pomp to the whole view; but the builders of that pile did not trouble themselves much about beauty, and I believe it is mere accident that even the situation itself is so favourable.

We must now pass into Piccadilly, where we shall be entertained with a sight of the most expensive wall in England; I mean that before Burlington House. Nothing material can be objected to it, and much may be said in its praise. It is certain the height is wonderfully well proportioned to the length, and the decorations are both simple and magnificent; the grand entrance is august and beautiful, and by covering the house entirely from the eye, gives pleasure and surprise, at the opening of the whole front with the area before it, at once. If any thing can be found fault with in this structure, it is this—that the wall itself is not exactly on a line; that the columns of the gate are merely ornamental, and support nothing at all; that the rustic has not all the propriety in the world for a palace; and that the main body of the pile is hardly equal to the outside. But these may be rather imaginations of mine, than real imperfections; for which reason I submit them to the consideration of wiser heads.

That side of Arlington Street next the Green Park, is one of the most beautiful situations in Europe, for health, convenience, and beauty, the front of the street is in the midst of the hurry and splendour of the town, and the back in the quiet and simplicity of the country. It is not long since, too, that the whole row was harmonious and uniform, though not exactly in taste; but now, under the notion of improvement, is utterly spoilt and ruined, and for the sake of the prospect behind, the view before is disjointed and broken to pieces.

I have now finished one of my walks from Lincoln's Inn Fields to Hyde Park Corner, and, according to promise, am now to go back to Temple Bar, in order to comment on the most remarkable things in my way to Westminster.

The New Church in the Strand is one of the strongest instances in the world, that it is not expense and decoration that are alone productive of harmony and taste: the architect of this pile appears to have set down with a resolution of making it as fine as possible, and, with this view, has crowded every inch of space about it with ornament: nay, he has even carried this humour so far, that it appears nothing but a cluster of ornaments, without the proper vacuities, to relieve the eye, and give a necessary contrast to the whole: he ought to have remembered that something should first appear as a plan or model to be adorned, and the decorations should be only subordinate to that design; the embellishments ought never to eclipse the outline but heighten and improve it. To this we may safely add, that the dividing so small a fabric into two lines or stories, utterly ruined its simplicity, and broke the whole into too many parts. The steeple is liable to as many objections as the church, it is abundantly too high, and, in the profile, loses all kind of proportion, both with regard to itself and the structure it belongs to. In short, this church will always please the ignorant, for the very same reasons that it is sure to displease the judge.

York-stairs is unquestionably the most perfect piece of building, that does honour to the name of Inigo Jones: it is planned in so exquisite a taste, formed of such equal and harmonious parts, and adorned with such proper and elegant decorations, that nothing can be censured, or added. It is, at once, happy in its situation, beyond comparison, and fancied in a style exactly suited to that situation. The rock-work, or rustic, can never be better introduced than in buildings by the side of water; and, indeed, it is a great question with me, whether it ought to be made use of any where else.

Northumberland House is very much in the Gothic taste, and, of course, cannot be supposed very elegant, and beautiful; and yet there is a grandeur and majesty in it that strikes every spectator with a veneration for it: this is owing intirely to the simplicity of its parts, the greatness of its extent, and the romantic air of the four towers at the angles. The middle of the front next the Strand, is certainly much more ancient than any other part of the building, and, though finished in a very expensive manner, is a very mean and trifling piece of work. It may serve indeed to preserve the idea of the original pile, and acquaint the moderns with the magnificence of their forefather; but then it breaks the uniformity of the whole, and might be spared with more propriety, than continued.

The statue at Charing-cross has the advantage of being well placed; the pedestal is finely elevated, and the horse full of fire and spirit; but the man is ill designed, and as tamely executed: there is nothing of expression in the face, nor character in the figure, and though it may be vulgarly admired, it ought to be generally condemned.

When I have stood at this place, I have often regretted that some such opening as this had not been contrived, to serve as a centre between the two cities of London and Westminster, and from whence, particularly, the cathedrals of St. Paul's and the Abbey might have been seen, as the terminations of the two vista's: I am of opinion that nothing in Europe would have had a finer effect; but now it is impossible it should ever take place, and I mention it only by way of hint, that private property is, generally speaking, the only bar to public ornament and beauty.

The new Admiralty was erected on a spot of ground, which afforded the architect room for all the beauties his imagination could suggest, and the expence it was raised at, enabled him to execute all that beauty in a grand, though simple manner; how he has succeeded, the building is a standing evidence; and very much concerned I am to see a pile of that dignity and importance, like to continue a lasting reproach of our national want of taste.

I must ingenuously confess that the number of pretty little boxes, that are built on the ruins of Whitehall, make me no satisfaction for the loss of that palace; not that I believe it ever was a fine structure, but because it might have been so; because no piece of ground, so near two great cities, could afford a finer situation; with so noble a river on one side, and so beautiful a park on the other: and because Inigo Jones's plan for rebuilding it is still forthcoming, and may be made use of to erect a structure equal to the situation.

The majestic sample he has given of his art in the Banquetting House, is a continued persuasive to incline us to wish for the rest of that magnificent pile, of which this was intended to be so inconsiderable a part: to be sure if ever this could be effected, Britain might boast of a palace, which might excel even the proud Versailles, and be as much visited too, in compliment to its superior taste.

I cannot leave this place without taking some notice of the admirable ceiling, performed by Rubens, which is beyond controversy, one of the finest things of the kind in Europe. It is indeed not so generally known as one could wish, but it needs only to be known to be esteemed according to its merit. In short, it is but an ill decoration for a place of religious worship; for in the first place, its contents are no ways akin to devotion, and in the next, the workmanship is so very extraordinary, that a man must have abundance of zeal, or no taste, that can attend to any thing beside.

Before I quit this place, I must take notice of the brazen statue, erected here in honour of James II. The attitude is fine, the manner free and easy, the execution finished and perfect, and the expression in the face inimitable: it explains the very soul of that unhappy monarch, and is therefore as valuable as if it commemorated the features and form of a hero. In short it is a pity it is not removed to some more public and open place, that it might be better known, and more admired.

Marlborough House is another instance of great expense, but no taste: it consists only of a range of windows or two; a certain quantity of unmeaning stone, which was intended for a decoration, and a weight of chimnies over all, enough to sink the roof to the foundation. It is certain the ground afforded the architect all the opportunity imaginable of exerting his utmost art and genius, and if he had, the very place itself would have secured him the highest applause.

It is with no small concern, I am obliged to own that the palace[*] of the British kings is so far from having one single beauty to recommend it, that it is at once the contempt of foreign nations, and the disgrace of our own: it will admit of no debate that the court of a monarch ought to be the centre of all politeness; and a grand and elegant outside would seem, at least, an indication of a like perfection within: we may safely add, that this is necessary even in a political sense: for strangers very naturally take their impressions of a whole people by what they see at court, and the people themselves are, and ought to be dazzled by the august appearance of majesty, in everything that has any relation to it. I could wish, therefore, that ways and means could be invented to bring about this necessary point; that Britain might assert her own taste and dignity, and vie in elegance, as well as power, with the most finished of her neighbours.

As we proceed on to Westminster,[†] a city long famous for its antiquity, yet producing very little worthy of attention, and less of admiration, we will begin with the house on the left hand of King Street, and near adjoining to Privy Garden; not that it is in any way remarkable in itself, but because it has one of the most elegant irregular views before it of any house in town; the street before it forms a very spacious and noble area. And yet, with all its advantages, the house is a public nuisance, as well as all those in King Street, Channel (Cannon) Row, and the entire space between; nothing in the universe can be more absurd than so wretched a communication between two such cities as London and Westminster, a passage which must be frequented by all foreigners, which is visited even by the sovereign himself many times a year, which is the road of all the justiciary business of the nation, which is the only thoroughfare to the seat of the legislature itself, and the rout of our most pompous cavalcades and processions: surely such a place as this ought, at least, to be large and convenient, if not costly and magnificent, though, in my opinion, it ought to be made the centre of our elegance and grandeur; and to do this effectually, all the buildings I have complained of ought to be levelled to the ground, and a space laid open from Privy Garden to Westminster Hall on one side, and from the west end of the Abbey to Storey's Gate on the other; this should be surrounded with stone buildings all in a taste, raised on a piazza or colonnade, with suitable decorations, and the middle should be adorned with a group of statues, answerable to the extent of the circuit round it. It is easy to imagine what an effect such an improvement as this would have on the spectator, and how much more agreeable it would be to the honour and credit of the nation.

I should farther desire, too, to see all the little hovels demolished which now incumber the Hall and the Abbey, that those buildings might be seen at least, and if they could not be admired for their beauty, they might be reverenced for their greatness and antiquity. If St. Margaret's were removed with the rest, it would be yet a farther advantage; for then the fine chapel of Henry VII. would come into play, and be attended to as it deserves. I am very far from expecting or even imagining that any of these alterations will ever come to pass; I mention them only to explode the miserable taste of our ancestors, who neglected, or did not understand, these beauties; and that their descendants may grow wiser at their expence, and prevent the like censures from falling upon them.

I am sometimes inclined to wish that the place which is now called Hell, was levelled, and that the new Parliament House should be erected there in its room; it would certainly have a noble effect on the prospect, and form a most admirable contrast to the ancient edifices of each side of it: I have indeed an objection or two to this part of the scheme; first, I apprehend there is not room enough there for such a pile; and, secondly, it would lose the advantage of a prospect from the river, which its present situation might so happily allow it.

At all events, however, I should be glad to see this noble project put into execution: it is certain nothing can be more unworthy of so august a body as the parliament of Great Britain, than the present place of their assembly: it must be undoubtedly a great surprize to a foreigner, to be forced to enquire for the Parliament House even at the doors; and when he found it, to see it so detached in parcels, so incumbered with wretched apartments, and so contemptible in the whole: I could wish therefore to see this evil remedied; to see so useful and necessary a scheme take place: and if it falls into the noble hands to execute, we have long been flattered to believe it would, there is no room to doubt but the grandeur of this appearance will answer the majestic purposes it is to be employed in. The British taste in architecture, is, to be sure, more obliged to that nobleman,(?) than any other person now living, and if Inigo Jones has any advantage, it is only in having lived before him.

It will be ridiculous and foolish therefore, in me, to give the least hint for the conduct or improvement of any design which he has engaged in; I shall therefore say no more than this, that I should be glad to have both houses under the same roof, built on the same line, exactly opposite to each other, the seats ranged theatrically, the throne in the midst of one semicircle, the speaker's chair in the other; and that when the king made his speech, ways and means might be found to remove the partitions from between the two houses, and present the whole parliament of Britain at one view, assembled in the most grand, solemn, and elegant manner, with the sovereign at their head, and all the decorations round them, which could strike the spectator dumb with admiration, at the profusion of majesty, which set off and adorned the whole.

After such a scene as this has been presented to the imagination, no other has importance enough to be attended to: I expect therefore that what has been said of Westminster Hall will meet with but a cool reception. The structure is remarkable only for being the largest room in Europe which has no column to support it: all that is excellent in it, therefore, is to be found in the contrivance and workmanship of the roof, and no doubt both are truly admirable: but as skill and contrivance are both thrown away, unless they are to be seen in effect, so a room of half the extent of this, supported on beautiful pillars, and graced with suitable cornices, according to the antique, would excite a great deal more applause, and deserve it infinitely better.

(To be continued.)

NOTES ON ARTESIAN WELLS AND WELL BORING IN FRANCE.

(From French Publications.)

M. Champoiseau has communicated to "the Academy of Sciences" the result of the experiments which he made at Tours, to ascertain the relation which existed between the water of his artesian well, and that of the neighbouring rivers. These experiments were continued for more than three months (March, April and May), and did not show any variation in the produce at any time, whatever were the variations in the rivers round Tours, or in the tides; neither was the limpidity of the water at all affected. Indeed the apparatus did not exhibit any sensible change in the well water, and the conclusion drawn is that the artesian wells of Tours, from the great elevation of their feeding springs, are not exposed to the irregularities observed elsewhere.

A singular circumstance recently occurred during the construction of the Left Bank Versailles Railway, near Val de Fleury, varying in its operation, and its treatment from some similar instances, which occurred on the London and Birmingham, and other railways here. A large embankment was in progress to join the viaduct then building, but the deposit of earth had scarcely begun when an extraordinary motion was communicated to the adjoining soil. In two places it was lifted up 8 or 10 yards above the surface, the road was blocked up, and several houses on the disturbed site were upset. It was found that this operation proceeded from a stratum of clay, mixed with sand, and soaked with last year's rains, so as to become fluid; that the weight of the embankment 30 yards high, and that of the superincumbent strata had put this pulpy mass in motion, and that it had disturbed the adjoining soil on the slope of the valley, and had in several places lifted up and broken through the upper strata. The cause was apparent that water did the mischief, and though it might not have shown itself immediately if the season had been dry, yet ultimately it would have been productive of serious evil. To remedy this, there were no other means than to stop the flow of water arriving from the upper levels; to carry which into effect it was necessary to cut the clay stratum and replace by stone work, which would surround the site on which the embankment was to be formed and divert the water. This operation was found exceedingly difficult, having to be carried on at a depth of from 6 to 20 yards in a moving soil, saturated with water; it was long, very dangerous, and an accident might have wasted much valuable time, the works of the embankment being suspended in the meanwhile, and the stone-work itself being liable to be swallowed up in a few years, and the work to be done over again.

---

[*] St. James's.

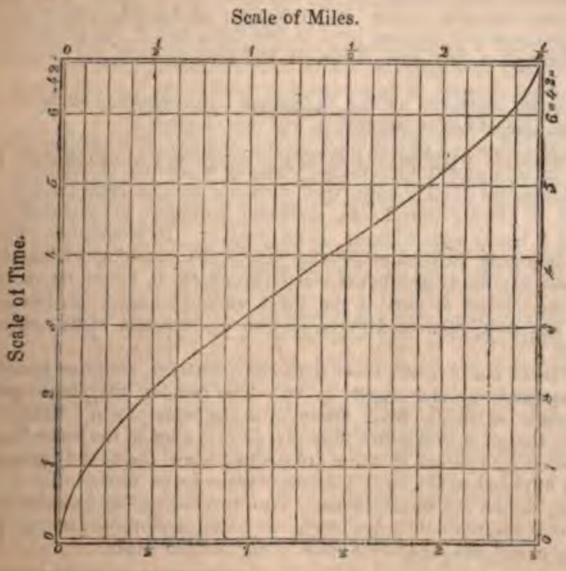
[†] We have retained this part of Ralph, although several improvements have taken place since his day in this part of Westminster.—ED.

Under these circumstances the engineers thought it advisable to have recourse to boring for the purpose of absorbing the water, and applied to the General Well-boring Company at Paris. This mode was also difficult, as the boring tube got plugged up in the soft stratum as fast as it was emptied, but by means of good tools this was at last got over. The first boring reached 20 yards and got into the upper part of the chalk, notoriously full of fissures, and where the water was rapidly absorbed. The second and third borings were carried to 35 and 40 yards in order to get at the chalky fissures which communicate with the Seine, and feed the neighbouring wells. A series of borings will therefore be carried round the embankment at proper distances and drains if necessary made to carry the water into the borings which can easily be kept clear by means of a valve and cord. It is proposed also to apply this method to get rid of the water in sand, but this necessarily depends on the strata, for we believe that in the Kilsby tunnel it would not have been practicable.

SPEED ON RAILWAYS.

Diagram, showing the variations in the speed of a locomotive engine and train over a journey of 2½ miles, on a level railway. In the first instance starting from a state of rest and getting up the speed; then travelling one mile at the rate of thirty miles an hour; and ultimately being brought again (by the use of the break) to a state of rest.

From numerous observations, by R. Sheppard.



HYDRAULIC WORKS AT ALGIERS.

By M. Poirel, Engineer of Bridges and Roads.

Translated from the Annales des Ponts et Chaussées by W. H. Emory, Jun., U. S. Topl. Engrs., for the Franklin Journal.

The port of Algiers was established as far back as the year 1530, by Cheredin, brother of Barbarossa. Having made himself master of a little island, in front of the city, which Spaniards had fortified, he resolved, in order to secure it, and at the same time to make, at Algiers, a harbour that would afford protection from the winds and from the swell of the sea, to unite it to the town by means of a jetty. This is called the Cheredin jetty, and is two hundred and twenty-three yards long, and one hundred and twenty-seven yards wide. Its direction is nearly east north-east, or west south-west.

Besides the Cheredin jetty, another has been built on the prolongation of the island, which protects the harbour from easterly winds, and is called the mole. It is one hundred and seventy-four yards long, and forty-five yards in its greatest width. This mole runs north-east and south-west. These two jetties with the little mole on which the Lazaretto stands form the boundary of the basin. It contains forty thousand seven hundred and twenty-two superficial yards, and can float sixty vessels, of which about thirty, may be vessels of three hundred tons, and some few, eight hundred tons. Vessels of a larger class anchor outside the basin. The greatest depth of water is sixteen and a half feet; but this may be increased by dredging. The Cheredin jetty and the mole were found in a state of complete dilapidation when Algiers fell into the hands of the French. These two works constructed of loose stone, (rubble) were levelled to their base. The Deys were in the habit every year of having the stones replaced which were carried away in the winter by the sea.

Laugier de Tassy, one of the most faithful historians of the Algerine regency, who resided there in 1727, says:—

"The great mole (the Cheredin jetty,) being entirely exposed to the north, to prevent it from being carried away by the furious swells of the sea, which roll up the sand bank, stretching along this mole and out into the sea, they were obliged to keep the slaves of the beylick employed the whole year carrying hard stones from a place near point Pescade, to put them along the mole. The sea soon carried away the stones thus deposited, but care was always taken that they should be replaced."

Large magazines of military supplies are placed on the Cheredin jetty, and it naturally claimed the first attention of government.

The preservation of these magazines required that the loose stone upon which they rested, at the base of the jetty, should be secured.

This undertaking was confided to M. Noel, the engineer, in charge of the hydraulic works at Toulon, from which he was temporarily relieved.

He rebuilt the entire body of the jetty to a height of sixteen and a half feet above the water, with a thickness of six and a half feet. The new masonry is of the very best kind, and possesses great solidity; unfortunately the insufficiency of funds placed at the disposal of the engineer, and his limited time did not permit him to turn his attention to the foundation of the jetty which will soon require considerable repair.

The extremity of the mole, called the chop, in which the sea made a large breach, was repaired in 1831, but the new masonry being built upon the fragments which the action of the sea had brought down, was entirely destroyed by the first storm in the winter of 1832. All the repairs made to the top of the work were necessarily liable to the same catastrophe, as the base upon which they rested was insecure. It became necessary, therefore, before proceeding farther, to reconstruct the base permanently and durably.

The locality did not permit the engineer's resorting to the ordinary means of establishing a foundation by throwing over loose stones, (rubble.) The shore to the west, where the quarries are, has not a single creek or harbour where a vessel could load; it is open to the ocean and skirted by a reef of rocks which make the landing dangerous even in a calm. The transportation of blocks of stone could only be effected by carriages, a tedious and difficult operation with masses, which, to resist the action of the waves, should measure at least four cubic yards. Besides which it would have been necessary to carry these blocks through the most frequented and populous part of the city, very much to the inconvenience of the inhabitants passing to and fro. Another difficulty presented itself, even if the obstacles to an easy transportation had been overcome. To give sufficient stability to the work at the end of the mole, a long slope of at least one in ten was necessary, which would have entirely obstructed the navigation, as the entrance to the basin was already very narrow, being only one hundred and thirty-four yards wide, measuring from the end of the mole on which the Lazaretto stands, to that of the work in question.

Under these circumstances, the engineer was obliged to resort to other expedients, and he was thus led to form and execute a new plan for establishing foundations at sea, which five years experience of the works at Algiers has proved to be, according to all accounts, superior to all those which have heretofore been put in practice, and particularly to those made of rubble work; a method much approved of since the construction of the Cherbourg and Plymouth breakwaters, the two most important maritime works executed in modern times.

The principal feature of this plan is the use of blocks made of béton. These blocks are of two kinds; one being constructed in the water at the place it is intended to occupy, the other made on shore and launched.

The first is made by pouring the béton into cases without bottoms, sunk on the place where the block is to rest. The frames of these cases are made by putting together pieces of scantling in a rectangular form, to which are nailed two courses of plank placed at right angles to each other. The lower edges of the cases are cut out to fit the profile of the surface on which they are to rest. They are lined with tarred cloth, throughout the whole extent of the inside up to the level of the water. The cloth at the bottom is allowed sufficient fullness to accommodate itself to the inequalities of the ground. The cases are thus, in fact, converted into cloth sacks, the sides of which are strengthened by the timber work on which they are stretched and fastened. The cloth sacks enable the mass of béton to accommodate itself perfectly to the surface which receives it, the inequalities of which serve to bind together the rock forming the bottom, and the béton. This is a great advantage in the use of these cases, for with the flat bottomed ones generally used, it is necessary to level the surface to be built upon, which is a difficult and uncertain operation.

The cloth bottomed cases are built upon stocks, launched and floated to the place they are to occupy. They are then sunk by means of small wooden boxes, one foot square, filled with cannon balls or pig-iron strung entirely round on the outside of the case, about one foot and a half from the top, by means of a cable passing through iron rings fixed in the uprights.

A similar use of béton was made by the Italians to prevent the disintegration of masonry immersed in water. They filled, with béton, bags similar to those used in fortification for making earth defences, and placed them compactly, one upon the other, and in such a manner as to fill up the inequalities of the surface on which they rested. The cement which oozed out through the interstices of the cloth, bound the little rolls of béton together and soon formed a very compact and durable mass. The cloth between the joints rotted and disappeared in a few years. On one occasion, they filled a much larger sack with béton than those above described, and threw it into the sea in stormy weather; some days after the storm had subsided they found this block very hard and strong. From the result of this experiment it was natural that the adoption of very large blocks of béton should be thought of, but the difficulty consisted in making bags of those dimensions which would not burst, and fixing them in position, while being filled with béton.

When the case is moored, the béton is lowered and deposited in it by means of a trough, which has a vertical and semi-rotary motion communicated to it by a cylinder worked at each end by a crank. This trough which contains a little more than a cubic yard, gives the advantage of putting in the case a large quantity at a time. The operation is thus made more rapid and there are fewer seams.

The béton blocks made on shore are moulded in cases consisting of four sides made of thick planks and lined on the inside with another course of plank jointed together at the bottom and removable at pleasure. The bottom rests upon two large sills connected transversely, forming an inclined plane which terminates at the point where the block is to be launched. These cases like the others, are entirely empty and without shores. When they are filled with béton, and it becomes sufficiently hard, the sides are taken off and the block thus stripped is launched into the sea.

The mortar used in the large cases with cloth bottoms, is formed of one part fat lime and two parts of Italian puzzolana; that used for blocks on shore is composed of puzzolana and sand in equal proportions.

The lime should be made from the grey transition limestone, fine grained and very hard; slaked in the ordinary way, and reduced to the consistency of thick paste, it absorbs two and a half times its weight of water. Its bulk is increased in the proportion of 1 to 1·8.

The puzzolana is the same as that used along the Mediterranean coast in the formation of hydraulic mortars. It is to be found in the neighbourhood of Rome. The best comes from Saint Paul's cave, near the church of that name. This puzzolana is brought by waggons to the Tiber, and thence by batteaux to Civita Vecchiá, whence it is exported. It is sent abroad in the natural condition in which it is found, the pieces varying in size from that of an egg to the smallest grain of sand. M. Jullien, the engineer, found by experiment that the very finest grains were the only ones that could be used with effect in hydraulic mortars, and that when it was used in grains as large, for example, as the largest grains of sea sand, it was as ineffectual as the sea sand itself. From this it appears to be necessary that the finest grained puzzolana alone should be used in hydraulic works; and as its efficacy and quickness in hardening are in proportion to the fineness, too much pains cannot be taken to pulverize it.

Acting on this principle, the puzzolana brought from Italy and Africa for the work on the mole was sifted at Algiers before being used. One half, forming the residue, was ground in a mortar mill and sifted again, leaving a residue of one-tenth.

That ground and sifted was of a quality inferior to that furnished by the first sifting. The price of the puzzolana delivered at the work was thirty-six francs per cubic yard, and the cost of sifting, grinding, &c., twelve francs, making the total cost forty-eight francs.

The cost of labour at Algiers, independently of the inferior quality of the puzzolana obtained by trituration, and the consequent increase of expense, made it desirable that it should be sifted at Rome and the refuse left there. The soil on which this city and its environs stand, is composed of this material, and is of course very cheap. The only difference in the price would therefore arise from the cost of sifting, which could be more than balanced by the freight saved in leaving the refuse.

Influenced by these considerations, the author, on the requisition of the Governor General was authorized by the Secretary of War to repair to Rome and superintend in person, the details of the operation. He there fixed up a number of strong bolting cloths pierced with small rectangular holes. The price of sifting one cubic yard of puzzolana with labour hired of the pontifical government, was about twenty cents.

The contractor who has leased from the Roman government, the monopoly in the puzzolana trade, regarding the project as impracticable, asked an exorbitant price for taking charge of it, but as soon as he discovered it was both easy and cheap, he came forward and offered for the future to send none but the sifted puzzolana to Algiers. It was delivered there in 1837, in this state, for forty-two francs the cubic yard, and could, without doubt, be delivered for forty francs. By adding one half sand, quite as good a commodity as the rough puzzolana is produced, and you get for twenty francs what formerly cost thirty-nine. At this price this material is likely to supersede all the hydraulic lime and artificial cements made at the different localities. It is easier worked, and the quality is superior, or at least equal.

Algiers is not the only place where this measure can be adopted advantageously; it can be practised with advantage on the whole Mediterranean coast and wherever the puzzolana of Italy is used. The engineers of Toulon and Marseilles have already made arrangements for the importation of the sifted puzzolana, and there is little doubt but that it will become an extensive article of traffic.

The mortar is made with one part lime in paste, and two parts puzzolana. If the puzzolana is in the rough state the mortar becomes hard in four days and resists the Vicat rod; if it is sifted through the bolting cloths it will become hard in two days, and if the puzzolana is sifted through a fine hair sieve, it will become hard in twenty-four hours.

It takes six days for mortar to become hard, which is made of one part lime, one of bolted puzzolana, and one of sand.

Béton is composed of one part mortar and two of stones broken to the size of from one to two inches,[*] making two parts of béton.

A cubic metre (35·317 cubic feet) of béton weighs 5885 pounds. It acquires in twenty-four hours, sufficient cohesion to withstand the shock of a heavy sea without disintegration. In November 1836, a block containing two hundred and fifty cubic yards, which had been immersed only thirty-six hours was stripped of its enclosure, and resisted the action of one of the most violent storms. M. Fénéon, a mining engineer, then at Algiers, was an eye witness of this remarkable fact.

The blocks made in the cases with cloth bottoms, measure generally from one hundred and eighty to two hundred and fifty cubic yards; those made on shore, from fifteen to sixty cubic yards. When constructing the mole at Algiers, they placed first a set of the large blocks, and then, in advance of them, to protect their bases, they placed a number of the second size. The large cases serve as a platform from which to launch the small blocks. The two lines of blocks are bound together at intervals by large blocks of béton, and these intervals are filled by stone measuring from five to eight cubic yards.

---

[*] Whether cubic or superficial measure, is not stated. Tr.

The following is an estimate of quantities and labour for a béton block, of thirty-six cubic yards, using mortar made of lime, sand and puzzolana:—

36 cubic yards of broken stone.
12 " puzzolana.
12 " lime in paste.
12 " sand.
1 day's labour for a master workman.
3 " three labourers.

The cases used cost about one hundred dollars, and one will answer for twenty blocks.

The whole cost of making and laying this béton at Algiers is about five dollars and seventy cents the cubic yard.

Estimate of quantities and labour for a béton block of one hundred and eighty-two cubic yards, sunk in a case with a tarred cloth bottom, caulked, using mortar made of lime and puzzolana:—

182 cubic yards of broken stone.
91 " puzzolana.
45½ " lime in paste.
1 master workman three days.
2 labourers for three days.

The construction and moving of the case cost about four hundred dollars; it can also be used twenty times.

The caulking at the angles, the cloth bottom and the removal of the case, cost about one hundred and seventy dollars.

The whole cost of making and laying this béton at Algiers, is estimated to be about eight dollars and seventy-five cents the cubic yard.

Colonel Emry published a work in 1831, containing many purely theoretical views, and at the same time many useful suggestions, in which he set forth, strongly, the inconveniences of the present system of building stone work in the sea, and proposed as a substitute, blocks made of béton.

The blocks that he proposed were also of two kinds, one kind made in the water, and the other on shore; the first was to be built in a flat bottomed case, and the other he proposed to transport to the place for immersion; a plan of doubtful success; he proposed, too, that these blocks, which were to be hexagonal prisms, should be laid regularly one upon the other, which we regard as impossible.

During the execution of the new system at Algiers, some engineers thought the success of it very doubtful; but the manner in which the end of the mole stands, puts all doubt to rest. This work projects into the sea towards the quarter whence the winds blow with most violence, and it stands without having sustained the slightest injury from the most furious tempests. Besides other unquestioned advantages presented by the use of béton blocks instead of loose stone, the difficulty is avoided of transporting the stone of the requisite size when the quarries are remote. This consideration amounts sometimes to an insuperable obstacle to the use of loose stone, while the béton can be used any where.

The Romans drew blocks of stone from Mount Circe to build the port of Anxium, a distance of ten miles; and the pontificial government was obliged to abandon the port of Auzo in consequence of the difficulty of finding a quarry in the neighbourhood, that would furnish proper stone to repair the jetties.

The Italians generally practise a mixed system. They build the foundation of loose stones, even in twenty or thirty feet water, and the top of masonry. The masonry is constructed in staunch cases, floated to the place required, and the workmen, secure from water, erect a wall usually of undressed stone and hydraulic mortar. The cases are thus sunk by degrees until they reach the loose stone. The details of this process are described in Belidor's Hydraulic Architecture, in his description of the manner in which the moles at Nice, Genoa and Naples were constructed.

The defects of this plan are very apparent; the bottom of the case rests upon an uneven and movable surface, and the consequence is, the masonry cracks open in many places. Moles thus constructed are soon destroyed; extensive repairs are required, which make it necessary to be continually throwing in loose stone. This is exemplified in the mole at Genoa, which shelters the harbour from the east winds, the end of which constantly requires repair.

When De Cessart projected his large conical cases, he was on the eve of discovering the simple and ingenious plan just described for establishing foundations; the great error which was committed, and which fully explained the difficulty encountered by so skilful an engineer, was in sapposing that a wooden structure, however substantially constructed, could resist the action of the sea. Acting on this principle, he filled his cases with small stones to keep them in place; the consequence was that when the action of the sea beat these cases to pieces, the stones fell down and the whole fabric was swept away. De Cessart should have considered the case as simply a temporary enclosure to build masonry in, which would be capable of resisting the force acting against it after the cases were destroyed. If he had taken up this idea, it would probably have led him to the use of béton for filling his cases. Instead of making these cases as substantially as was proposed, it would be sufficient to give them the form of a large cask without a bottom, made with uprights and staves bound together by iron chains instead of hoops, in such manner that the uprights can be taken apart when the case is to be taken up. Another indispensable condition is, that the case should be filled in the shortest possible time. The sea at Algiers is very powerful considering the little range it has; and it would be necessary to make such arrangements that a case made to contain about 1300 cubic yards, should be filled in thirty-six, or forty-eight hours. This might be done by throwing in bèton blocks, ready made, at the same time pouring in béton to bind them, by means of cloth funnels fixed to the cases. This suggestion has never been acted upon, but if the intention of making Algiers a military port be carried out, there will be an opportunity of trying it on a large scale, and it is believed with complete success.

Whatever may be the fate of this or other plans for using béton, one thing is certain, that sooner or later, the practice of making foundations at sea with loose stone will be entirely abandoned, and masses of the natural rock so costly in quarrying and transportation, and so insufficient in dimensions, will be replaced by artificial blocks made of béton.

THE EFFECT OF CURVES ON RAILWAY CARRIAGES.

Sir—The influence of railway curves on engines and carriages passing along them, appears to have been paid little attention to by those persons who have had the best opportunities of acquiring information on the subject; at least, I am not aware that the results of any observations on the subject have been made known to the world. The only remark bearing on the matter which I have seen published, is contained in a letter by Mr. J. Ely, at page 139, vol. 2, of your Journal, in which he asserts "that when an engine is entering upon a curve, it will be affected by the nature of the path it was previously describing, and that the wear and tear of the *outer* rail at the commencement of a sharp curve is *less* when the previous path is a curve in an opposite direction (forming an S), than when it is a straight line." I do not for a minute doubt the correctness of the latter part of his assertion, but think that the inference he would draw from it, that an S curve is preferable to a straight line connected with a single curve, is erroneous. If you consider the subject, you will instantly perceive that the outer rail at the *commencement* of a reversed curve, would scarcely be affected by the grinding of the wheels, but that the inner rail would have all the wear and tear which is, simply, not from the engine or carriages being influenced by the path they were previously describing, in the sense which he applies it, but from the centrifugal power throwing the carriages against the outer rail of a curve, and which, at the point where the curve is reversed, has not had time to be counteracted, and which will not be the case until the carriages have passed a considerable distance into the second or contrary curve, when the wheels will begin to grind the outer rail of this curve as they did that of the preceding. My principal reason for addressing you is to draw attention to the great wear and tear of engines and carriages caused by their traversing curves, and to induce an inquiry into the subject, for the purpose, if possible, of modifying the evil. My opinion on the matter is, that any engine or carriage, in traversing a curve, undergoes a degree of torsion in the framing, and thereby partially adapts itself to the path which it is traversing, and which, with a slight degree of sliding of the wheels on one side, enables it to pass along the line without such a vast increase of friction as might reasonably be inferred. Now if such is the case, and a carriage is drawn or propelled along an S curve, the extremes of torsion will almost instantly take place where the two curves join, the framing being then twisted in the contrary direction, and the destruction of carriages must be commensurately great with the suddenness or violence with which the change is effected. I would therefore offer, as a partial remedy, the laying in of a short tangent line to the two curves in every instance, instead of an S curve, whereby the extremes of torsion, in place of being sudden, and I presume destructive, as in the latter, would be gradually effected, first by the restoration of the framing to its square form, and then by the slight torsion in the contrary direction. If this plan was pursued, I have no doubt very much greater durability in the engines and carriages would be the consequence. Perhaps some of your readers who have opportunities of minutely observing the effects which I have described, and also the effect where sharp curves are connected with a tangent, will, at some future time, communicate the results.

June, 1840. B.

SUSPENSION BRIDGES.

On the Theory of Suspension Bridges, with some account of their early history. By Mr. G. F. Fordham, *read at the Scientific Society, March* 12, 1840.

Suspension bridges appear to be of very ancient origin; travellers have discovered their existence in South America, in China, in Thibet, and in the Indian Peninsula. They are most frequently met with in mountainous regions, and being suspended across a deep ravine, or an impetuous torrent, permit the passage of the traveller where the construction of any other kind of bridge would be entirely impracticable. Humboldt informs us, that in South America there are numerous bridges of this kind formed of ropes made from the fibrous parts of the roots of the American agavey (*Agave americana*). These ropes, which are three or four inches in diameter, are attached on each bank to a clumsy frame work composed of the trunk of the *Schinus molle;* where, however, the banks are flat and low, this framework raises the bridge so much above the ground as to prevent it from being accessible. To remedy this inconvenience steps or ladders are, in these cases, placed at each extremity of the bridge, by ascending which all who wish to pass over, readily reach the roadway. The roadway is formed by covering the ropes transversely, with small cylindrical pieces of bamboo. The bridge of Penipé, erected over the Chambo, is described as being 120 feet long, and 8 feet broad, but there are others which have much larger dimensions. A bridge of this kind will generally remain in good condition 20 or 25 years, though some of the ropes require renewing every 8 or 10 years. It is worthy of remark, as evincing the high antiquity of these structures, that they are known to have existed in South America long prior to the arrival of Europeans. The utility of these bridges in mountainous countries, is placed in a striking point of view by the fact mentioned by Humboldt, of a permanent communication having been established between Quito and Lima, by means of a rope bridge of extraordinary length, after 40,000*l.* had been expended in a fruitless attempt to build a stone bridge over a torrent which rushes from the Cordilleras or the Andes. Over this bridge of ropes, which is erected near Santa, travellers with loaded mules can pass in safety.

But suspension bridges, composed of stronger and more durable materials than the twisted fibres and tendrils of plants, are found to exist in these remote and semi-barbarous regions; in Thibet as well as in China many *iron* suspension bridges have been discovered, and it is no improbable conjecture, that in countries so little known and visited by Europeans, others may exist of which we have as yet received no accounts. The most remarkable bridge of this kind, of which we have any knowledge in Thibet, is the bridge of Chuka-cha-zum, stretched over the Tchintchieu river, and situated about 18 miles from Murichom. "Only one horse is admitted to go over it at a time: it swings as you tread upon it, re-acting at the same time with a force that impels you every step you take to quicken your pace. It may be necessary to say, in explanation of its construction, that on the five chains which support the platform, are placed several layers of strong coarse mats of bamboo, loosely put down, so as to play with the swing of the bridge; and that a fence on each side contributes to the security of the passenger."[*] The date of the erection of this bridge is unknown to the inhabitants of the country, and they even ascribe to it a fabulous origin. The length of this bridge appears to be about 150 feet.

Turner describes in the following terms a bridge for foot passengers of an extraordinary construction. "It was composed of two chains stretched parallel to each other across the river, distant four feet from each other, and on either side resting upon a pile of stones, raised upon each bank about 8 feet high; they were carried down with an easy slope and buried in the rock, where being fastened round a large stone, they were confined by a quantity of broken rock heaped on them. A plank about 8 inches broad, hung, longitudinally suspended, across the river with roots and creepers, wound over the chains with a slackness sufficient to allow the centre to sink to the depth of four feet below the chains. This bridge, called Selo-cha-zum, measured, from one side of the water to the other, seventy feet. The creepers are changed annually, and the planks are all loose; so that if the creepers give way in any part, they can be removed, and the particular part repaired without disturbing the whole."

Numerous suspension bridges formed of iron chains exist also in China; and though the accounts which travellers have transmitted respecting them are less detailed and explicit than would have been desirable, descriptions of two of them have been furnished, which are sufficiently minute and intelligible to excite considerable interest. The first to which I refer is contained in Kircher's China Illustrata. The following is a translation of the author's words. "In the province of Junnan, over a valley of great depth, and through which a torrent of water runs with great force and rapidity, a bridge is to be seen said to have been built by the Emperor Mingus, of the family of the Hamæ, in the year of Christ 65, not constructed of brickwork, or of blocks of stone cemented together, but of chains of beaten iron and hooks, so secured to rings from both sides of the chasm, that it forms a bridge by planks placed upon them. There are 20 chains, each of which is 20 perches or 300 palms in length. When many persons pass over together, the bridge vibrates to and fro, affecting them with horror and giddiness, lest whilst passing it should be struck with ruin. It is impossible to admire sufficiently the dexterity of the architect Sinensius, who had the hardihood to attempt a work so arduous, and so conducive to the convenience of travelling." Another suspension bridge in this country is described in the 6th vol. of the "*Histoire générale des Voyages.*" The following is a translation: "The famous *Iron Bridge* (such is the name given to it) at Quay-Cheu, on the road to Yun-Nan (Junnan?) is the work of an ancient Chinese general. On the banks of the Pan-Ho, a torrent of inconsiderable breadth, but of great depth, a large gateway has been formed between two massive pillars, 6 or 7 feet broad, and from 17 to 18 feet in height. From the two pillars of the east depend four chains attached to large rings, which extend to the two pillars of the west, and which being connected together by smaller chains, assume, in some measure, the appearance of a net. On this bridge of chains a number of very thick planks have been placed, some means of connecting which have been adopted in order to obtain a continuous platform; but as a vacant space still remains between this platform and the gateways and pillars, on account of the curve assumed by the chains, especially when loaded, this defect has been remedied by the aid of planking supported on trusses or consoles. On each side of this planking small pilasters of wood have been erected, which support a roof of the same material, the two extremities of which rest on the pillars that stand on the banks of the river."[*] The writer proceeds to remark that, "the Chinese have made several other bridges in imitation of this. One, on the river Kin-cha-Hyang, in the ancient canton of Lo-Lo, which belongs to the province of Yun-Nan, is particularly known. In the province of Se-Chuen there are one or two others, which are sustained only by ropes, but though of an inconsiderable size, they are so unsteady and so little to be trusted that they cannot be crossed without sensations of fear."

While our attention is directed to early accounts, and to the origin of suspension bridges, it may be proper to remark, that although, as we have seen, the inhabitants of the mountainous districts of South America, or the wild and barbarous regions of Thibet, appear to have been well acquainted with the purposes for which these structures are best adapted, and to have practised their construction from the most remote ages, neither the Greeks, the Romans, nor the Egyptians, according to all we know of those nations had any knowledge of their uses or properties, or ever employed them as a means for crossing a river, or other natural impediment. It is not, therefore, from these celebrated nations of antiquity that the engineer has derived his first hints for the construction of suspension bridges, but from those rude and unpolished people, the results of whose ingenuity have just been described.

But it will now be interesting to inquire how far we can trace back the antiquity of suspension bridges in more civilized countries,—on the Continent, in the British Isles, and in the United States of America. Scamozzi speaks of suspension bridges existing in Europe in the beginning of the seventeenth century, but it is very questionable if he employed that term to designate the same structure to which it is now applied, and this is rendered the more improbable as no such bridges are now in existence, and other writers are totally silent upon the subject. It does not appear then that suspension bridges of other than recent erection have existed on the Continent, and in England the oldest of which we have any account has not been constructed more than a century. The first suspension bridge in the United States was erected in the year 1796. In England the oldest bridge of the kind is believed to have been the Winch Chain Bridge, suspended over the Tees, and thus forming a communication between the counties of Durham and York. Mr. Stevenson (Edinburgh Philosophical Journal) expresses his regret at not having been able to learn the precise date of the erection of this bridge; from good authority, however, he concludes it to be about the year 1741. It may also be mentioned here, that at Carric-a-rede, near Ballantoy, in Ireland, there is a rope bridge, which in 1800 was reported to have been in use longer than the present generation could remember.

In the years 1816 and 1817 some *wire* suspension bridges were executed in Scotland, and, though not of great extent, are the first example of this species of bridge architecture in Great Britain. As, however, full descriptions of these bridges are to be met with elsewhere, it will not be necessary to notice them farther.

---

[*] Turner's Embassy to the Court of Thibet.

[†] See Navier. Memoire sur les Ponts suspendus.

In 1818, Mr. Telford was consulted by government as to the practicability of erecting a suspension bridge over the Menai Strait, and was commissioned to prepare a design, if, upon an examination of the localities, he found the project feasible. Having accordingly surveyed the spot, he was led to propose the construction of a suspension bridge near Bangor Ferry, and in 1819 an act was obtained authorizing the erection of the bridge, a sum of money having been previously voted by Parliament for that purpose. This structure, which will always be regarded as a monument of the engineering abilities of Telford, was commenced in August 1819, and opened to the public on the 30th January, 1826, having occupied six and a half years in its erection. The Union Bridge across the Tweed was designed and executed by Captain Brown, and was the first bar chain bridge of considerable size that was completed in this country. It was commenced in August 1819, and finished in the month of July 1820. After the completion of the Menai Bridge, bridges on the suspension principle began to be universally adopted throughout Europe; but it was not till *iron wires* had been proved to be more *firm* than *bars of a greater thickness* that these bridges received their most extensive applications.* Since 1821 Messrs Sequin have constructed more than 50 wire bridges in France, with the most complete success.* The wire suspension bridge at Freyburg, in Switzerland, the largest in the world, was erected by Mons. Challey, and depends across the valley of the Sarine. It was commenced in 1831, and thrown open to the pubic in 1834. A suspension bridge has also been erected at Montrose, the size of which is scarcely inferior to that of the Menai bridge. At Clifton a very large suspension bridge is now in progress of erection by Mr. Brunel, and a suspension bridge 1600 feet in length is about to be erected over the Danube, between Pest and Offen, the design for which is the production of Mr. W. Tierney Clark, and under whose able superintendence its construction will be effected.

Having completed this sketch of the early history and subsequent progress of these interesting structures, I shall now proceed to investigate the *principles* upon which their stability depends, and by whose aid we are enabled to deduce practical rules for their construction. In this inquiry I prefer proceeding entirely upon abstract grounds, as by disencumbering our ideas of *material circumstances*, a greater facility of thought is conferred, and the results of the investigation are made to rest upon a broader and more certain basis. When a principle has once been established in a *general form*, its application will be found with comparative ease, as we have then only to observe that in substituting the particular for the general case, we do not violate any of the fundamental conditions of the problem.

The theory of suspension bridges is susceptible of division into two parts. I. The statical theory. II. The dynamical theory. In the first, we consider the forces which are developed, and the laws which are brought into operation, when all the parts are at rest; in the second, we suppose the action of the impressed force is evinced by the production of motion, and upon that supposition proceed to investigate the behaviour of each particle, and infer the effect of their combined motions. In the present paper the statical theory alone will be considered. The statical theory of suspension bridges is evidently involved in the general problem, *to determine the conditions of equilibrium of any forces whatever, acting in space upon points connected by lines wholly flexible and inextensible.* In the solution of this problem, then, we shall be gradually approaching our subject.

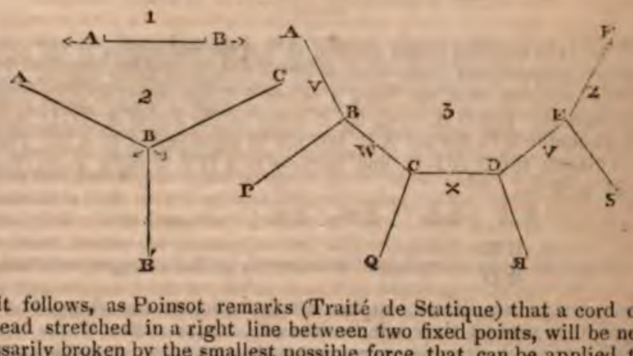
It is a principle in statical science, that when a body, acted on by any number of forces, is supposed to be at rest, all these forces must admit of being compounded into *two*, which are equal and opposite to each other. The same condition, it is evident, must exist with regard to each point, out of any number connected by flexible lines, provided the initial position of these lines be not a straight line, for then, it is clear, no medium exists through which the forces can be transmitted, and be made to act and re-act upon each other. This case may then be neglected in the present investigation, as it does not involve the *principle* of connecting lines, which here exert, in reality, no mechanical influence whatever. The same remark replies also when the connecting lines *are* right lines, if we still suppose that each point is in equilibrium by virtue of *those forces alone* which act upon itself. But since we easily conceive the transmission of force from one point to the adjacent one through the intervention of a connecting line, if that line be inextensible and a right line, it is perfectly clear that equilibrium may exist with regard to any number of points thus united, though each point should not, considered by itself, be in equilibrium by virtue of the forces applied to it, provided only we suppose that the interchange of force between two consecutive point be *mutual, equal* and *opposite*. Moreover, we shall suppose the forces to be receding forces, or such as tend to cause two bodies to proceed from each other. In general, then, it appears that in order that equilibrium may exist with regard to a system of points, which we suppose not to be in a state of independent equilibrium, it is only requisite that two simple conditions be observed. I. The line of connection must be a right line. II. The transmission of force between two points must be *mutual, equal* and *opposite*. It follows also, from the last condition, that the interchange of force will take place in the direction of the connecting line. We shall now proceed to show that these self-evident conditions being admitted, they may be resolved into others which have a more practical bearing. If, to begin with the simplest case, we take two points, A and B, fig. 1, we see at once, that equilibrium being supposed, each must be acted on by equal forces, whose direction are denoted by the arrows. If we now proceed to the case of three points, A, B, C, fig. 2, it is evident, that equilibrium subsisting, each two will be in equilibrium with respect to one another, and therefore, as we have seen, will be subject to equal and opposite forces. The directions of these are denoted by the arrows. Now, let the forces acting in the directions A B, C D, at the same point B, be compounded into BB^1 which represents their resultant, and we have, consequently, a system of three points kept in equilibrium by three forces, of which one is applied to each point. But as the forces acting at A and C, are transmitted through the connecting lines to the point B, and may be regarded as acting there, it is obvious the case differs in no respect from that of three forces in equilibrium around a single point. Consequently, calling the forces B A, BB^1 B C, P, Q, R, we have :—

$$\begin{aligned} P &: Q :: \sin.\ B^1BC : \sin.\ ABC \\ R &: Q :: \sin.\ ABB : \sin.\ ABC \\ P &: R :: \sin.\ B^1BC : \sin.\ ABB^1. \end{aligned}$$

Hence also, from these propositions may be found the values of P, Q, and R, in terms of two of the angles and one of the other forces. By comparing the values, $Q\frac{\sin.\ B^1BC}{\sin.\ ABC}$, $Q\frac{\sin.\ ABB^1}{\sin.\ ABC}$, of P and R, we observe that when $\angle ABB^1 = \angle B^1BC$, $P = R$, and B^1B produced bisects the $\angle ABC$. Let $\angle ABC = 2\beta$, $\therefore \frac{\sin.\ B^1BC}{\sin.\ ABC} = \frac{\sin.\ \beta}{\sin.\ 2\beta} = \frac{\sin.\ \beta}{2 \sin \beta \cos.\ \beta} = \frac{1}{2 \cos.\ \beta}$. Hence $P = R = \frac{Q}{2 \cos.\ \beta}$.

If Q remain constant, $P \propto \frac{1}{\cos.\ \beta}$, and if β remain constant, $P \propto Q$. If $\angle ABC$ be increased, $\cos.\ \beta$ is diminished, and it is therefore evident from the equation $P = \frac{Q}{2 \cos.\ \beta}$, that by increasing the $\angle ABC$ we increase the value of P; consequently, when A B C becomes a right line or $\beta = 90°$, the equation becomes $P = \frac{Q}{0} = \propto$.

Figs. 1, 2, and 3.



It follows, as Poinsot remarks (Traité de Statique) that a cord or thread stretched in a right line between two fixed points, will be necessarily broken by the smallest possible force that can be applied to it transversely, supposing the cord to be inextensible and not to have an infinite longitudinal resistance. It may be further remarked, that every material cord being composed of particles having weight, would, if extended between two fixed points lying in a horizontal line, be acted on by transverse forces of a definite magnitude; consequently no force, however large, would be sufficient to bring the cord into a horizonta position.

It is not difficult to extend the reasoning which has been used in reference to three points, to the case of any number of points, inextensibly and flexibly connected. Let the points be A, B, C, D, E, F, fig. 3; then, if the whole system be at rest, each pair of contiguous points will be at rest with respect to each other, and consequently will be connected by a straight line, and acted on by equal and opposite forces. By combining, as before, the forces at B, C, D, and E, we obtain their resultants P, Q, R, S, and we observe that, in general, any number of points may be kept in equilibrium by as many forces acting separately on each. For the sake of greater clearness, let us, however, imagine that two equal and opposite forces are made to act upon B, in the deductions B C, C B, respectively; then the system will be at rest as before, and if we suppose the force C B to act at C, the point B will be kept in equilibrium by three forces, B A, B C, B P. In the same manner, by superimposing equal and opposite forces at the points C and D, each will be kept at rest by three receding forces, two of which are always in the direction of the lines of connection. By calling the forces which act along the lines of connection V, W, X, Y, Z, we have therefore the following proportions:—

---

* See the Algemeine Bauzeitung.

$$\begin{array}{llll}
V : P & :: & \sin. PCB : & \sin. ABC \\
P : W & :: & \sin. ABC : & \sin. ABP \\
W : Q & :: & \sin. QCD : & \sin. BCD \\
Q : X & :: & \sin. BCD : & \sin. BCQ \\
X : R & :: & \sin. RDE : & \sin. CDE \\
R : Y & :: & \sin. CDE : & \sin. CDR \\
Y : S & :: & \sin. SEF : & \sin. DEF \\
S : Z & :: & \sin. DEF : & \sin. DES.
\end{array}$$

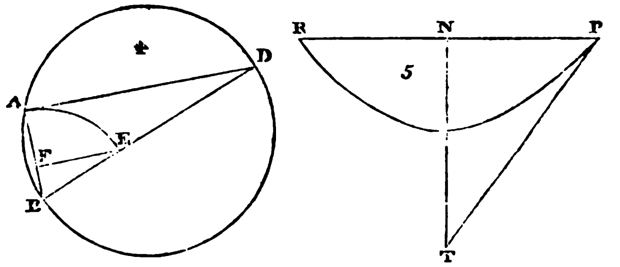
From these proportions the relation of any one force to any other may be determined, and consequently any force may be represented in terms of any other and the sines of the angles through which their lines of direction respectively pass. For example,

$$V = Z\,\frac{\sin. PBC}{\sin. DES}, \text{ and } P = S\,\frac{\sin. ABC}{\sin. DEF}.$$

If the original forces A B, C B, by the union of which the force P is obtained, were equal, P B produced will bisect the angle A B C, and the same is to be remarked of the forces Q, R, S; consequently, by the preceding proportions we have in this case, $V = W = X = Y = Z$. Moreover, denoting by 2α, 2β, 2γ, 2δ, the angles of the polygon, it follows:—

$$P : Q : R : S :: \cos. \alpha . \cos. \beta : \cos. \gamma : \cos. \delta.$$

Figs. 4 and .



That is to say, the forces applied at the several angles of the polygon are proportional to the cosines of the halves of those angles. Let us now suppose that the lines A B and B C are equal to each other. Through the points A, B, C, fig. 4, describe the circle A B C D, draw the diameter B D, the arc A E, and E F at right angles to A B. Then B D bisects the ∠A B C, and because B A D is a right angle (Euc. p. 31. b. 3):—

$$BA : BD :: BF : BE :: \cos. \alpha : \text{rad}.$$

$\therefore \cos. a = \frac{BA}{BD}$. Hence, as the forces P, Q, R, S, are proportional to cos. α, cos. β, &c., if we suppose all the sides of the polygon to be equal, it is evident they will be *inversely*, as the radius of the circle passing through the points terminating the two contiguous sides. But if we imagine the sides of the polygon to become indefinitely small, it then assumes the form of a curve, and the circle becomes the *osculating circle*, or the circle of equal curvature. If, then, a flexible curve, the two extremities of which are immoveably fixed, be acted on at points equidistant from each other by a number of normal forces, these forces will be *inversely as the radii of curvature* of the points of application, and the forces developed in the direction of the curve will be everywhere the same. If the normal forces be equal, the reciprocals of the radii of curvature will be equal, and therefore the radii of cur ture themselves; consequently, in this case, the curve will be parl a circle.

If the normal force vary as the cube of the cosine of the an formed by the ordinate and tangent at any point, the curve is a pa bola, as is proved by the following investigation.

Let P A R, fig. 5, be a parabola generated by the action of norr forces, P T the tangent at the point P and N T, the subtangent. I A N = x, N P = y, and p, the principal parameter or latus rectu also call the radius of curvature R, and the normal force V.

$$\text{Then, } \cos. NPT = \frac{NP}{PT}$$

$$\text{But } BP^2 = NT^2 + NP^2 = 4AN^2 + NP^2$$

$$\therefore \cos. NPT = \frac{NP}{\sqrt{4AN^2 + NP^2}} = \frac{y}{\sqrt{4x^2 + y^2}}$$

$$\text{Or since } y^2 = px, \cos. NPT = \frac{\sqrt{px}}{\sqrt{4x^2 + px}}$$

$$\therefore \cos.^2 NPT = \frac{px}{4x^2 + px} = \frac{p}{4x + p};$$

$$\text{Hence } \cos.^2 NPT \propto \frac{1}{4x + p}; \text{ or } \cos.^3 NPT \propto \frac{1}{(4x+p)^{\frac{3}{2}}}.$$

$$\text{But in the parabola } R = \frac{(4x + p)^{\frac{3}{2}}}{2\sqrt{p}};$$

$$\text{Or } \frac{1}{R} \propto \frac{1}{(4x + p)^{\frac{3}{2}}};$$

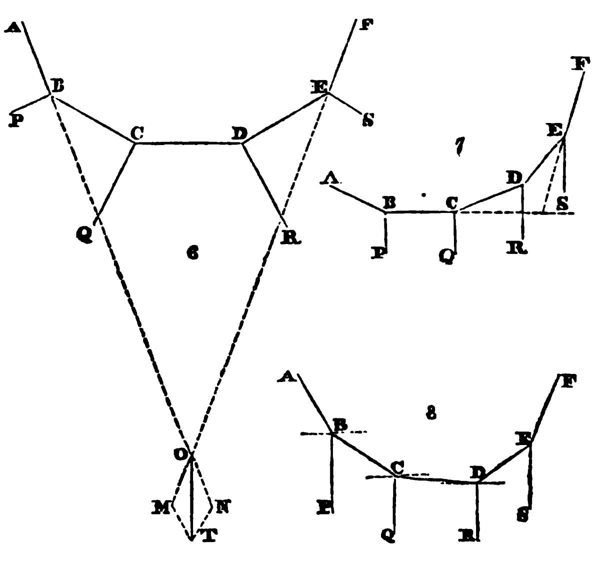
$$\text{Consequently } V \propto \frac{1}{R} \propto \cos.^3 N\text{[illegible]}$$

Let v be the normal force at the vertex, and denote by ϕ t ∠ N P T:—hence, because at the vertex $\cos. \phi = 1$,

$$v : V :: 1 : \cos.^3 \phi \qquad \therefore V = v \cos.^3 \phi.$$

Again, since in the catenary, $R \propto \frac{1}{\cos.^2 \phi}$,* ϕ denoting the an formed by the abscissa and tangent, it is seen at once, that wh $V \propto \cos.^2 \phi$, the curve is a catenary.

Figs. 6, 7, and 8.



Assuming the system of points A, B, C, &c. fig. 6, to be in equi brium, we shall now imagine the connecting lines to become perfect rigid. It is evident that this supposition will not affect the equil brium, as it does not involve the addition or abstraction of *force*, tl only agent by which equilibrium is preserved or destroyed. If the the system was in equilibrium before, it will remain so now, and v have consequently a rigid body acted upon by the forces V, P, Q, I

---

* Poinsot. Traité de Statique.

S, Z, which equilibrate each other. It follows, the resultant of two or more of these forces must be equal and directly opposed to the resultant of all the others, and if, therefore, A B, F E, be produced and intersect at O; the resultant of the forces P, Q, R, S will pass through the same point. Consequently, if the resultant be represented in magnitude and direction by the line O T, and a parallelogram be constructed, whose diagonal is this line, and whose sides, N O, M O, are drawn in the directions of B A, E F; N O, M O, will represent the directions and magnitudes of the forces to which the extreme points of the system, A and F, are subject. To proceed now to the case where P, Q, R, S, are parallel, fig. 7. The proportions we have before obtained will obviously apply here also, but in this case the supposition of equilibrium involves another condition, which was not before essential; all the forces must be situated in the same plane. For, as three forces are in equilibrium around the point B, they will necessarily be situated in the same plane, and the same can be asserted of C, D, and E; but B P, C Q, being parallel, B P, B C, and C Q are in the same plane (Euc. 7, 11); and consequently, all the forces acting at B and C are in one plane. By extending this reasoning to the points D and E, we observe that all the forces of the system will be situated in the same plane. Referring to the proportions already established, and remarking that sin. P B C = sin. B C Q; sin. Q C D = sin. R D C, &c. we have:—

$$\begin{aligned} V &: W :: \sin. BCQ : \sin. ABP \\ W &: X :: \sin. RDC : \sin. BCQ. \end{aligned}$$

And so of Y and Z. From this it appears, that when a number of parallel forces act upon points flexibly connected, the forces developed in the directions of the connecting lines, are inversely as the sines of the angles made by these lines with the parallel forces. These forces are therefore inversely as the cosines of the angle made by the sides with lines at right angles to the directions of the parallel forces; or denoting the angle by ϕ, and calling t the force thus devoloped;

$$t \propto \frac{1}{\cos. \phi} \propto \sec. \phi$$

When B C is at right angles to the parallel forces, we obtain the relation of the force acting in the direction C B to the force acting in the direction E F, by supposing, as before, that the intermediate lines C D, D E, have become rigid. B C and F E being produced will intersect at O, through which will pass the resultant of Q, R, S, equal to their sum and parallel in direction. Let this be called w, and denote by a the force acting in C B; then t being the force in E F, and ϕ the $\angle$ made by its direction with the direction of a, we have

$$t : a :: 1 : \cos. \phi;$$

$$\therefore t = \frac{a}{\cos. \phi} = \sec. \phi.$$

And $t : w :: 1 : \sin. \phi$,

$$\therefore w = t \sin. \phi.$$

It is also evident from these proportions, that

$$w : a :: \sin. \phi : \cos. \phi; \text{ from which } w = a\frac{\sin. \phi}{\cos. \phi}$$

$$\therefore w = a \tan \phi.$$

In order to compare the forces P, Q, R, S, let the angles formed by A B, B C, C D, fig. 8, with lines at right angles to the directions of the forces be called $\alpha, \beta, \gamma, \delta$. If therefore A B be produced, the $\angle CBb = \alpha - \beta$, and in the same manner $\angle DCc = \beta - \gamma$. Adopting this notation, we have these proportions:—

$$\begin{aligned} P : W &:: \sin. ABC\ (\sin CBb) : \sin. PBA \\ &:: \sin. (\alpha - \beta) \qquad\qquad : \cos. \alpha \end{aligned}$$

$$\therefore \frac{P}{W} = \frac{\sin. \alpha \cos. \beta - \cos. \alpha \sin. \beta}{\cos. \alpha} = \cos. \beta\,(\tan \alpha - \tan \beta)$$

$$\begin{aligned} \text{Again, } W : Q &:: \sin. QCD : \sin. BCD\ (\sin. DCc) \\ &:: \cos. \gamma \qquad : \sin. (\beta - \gamma) \end{aligned}$$

$$\therefore \frac{W}{Q} = \frac{\cos. \gamma}{\sin. \beta - \gamma} = \frac{\cos \gamma}{\sin. \beta \cos \gamma - \cos \beta \sin \gamma} = \frac{1}{\cos. \beta\,(\tan \beta - \tan \gamma)}$$

Finally, by multiplying these equations we have:—

$$\frac{P}{Q} = \frac{\tan. \alpha - \tan. \beta}{\tan. \beta - \tan. \gamma}.^{*}$$

The other forces will be found to be related in a similar manner. Let C D become perpendicular to C Q or D R, then $\tan \gamma = Q$, and $P : Q :: \tan. \alpha - \tan. \beta : \tan. \beta$; also, $P + Q : Q :: \tan. \alpha : \tan \beta$.

The principles we have now been considering have been established with regard to a polygon, acted on by given forces, but they may receive a more extended application, by imagining that the equal sides of the polygon become continually diminished until they are less than any assignable quantity, when, it is evident, we obtain *a curve*, or in other words, a polygon, the number of whose sides is infinite. This curve will vary in its nature, according to the magnitude and position o the forces by which it is generated; if, for example, the forces be *equal*, and *radiate* from the centre of the ordinate, the curve will be a semi-circle; if the forces are *parallel*, *equal*, and equally distributed *along the curve*, we obtain the catenary, and if, while equal and parallel, they are equally distributed along the *ordinate*, the parabola is the curve produced. The nature of the forces employed in the production of the semi-circle has already been shown; and with respect to the catenary, it is clear that this curve being defined, as the form which a flexible thread or chain assumes when freely suspended from its extremities, we shall obtain the same curve, if we replace the forces of gravity by others which are equal and parallel, whether their magnitudes be less or greater than the forces they have supplanted. The production of a parabola by equal and parallel forces uniformily distributed along the ordinate. I have succeeded in proving in the following manner:—In the first place, it is clear from what has been said, that whatever be the form of the curve, if we denote by w the sum of the forces acting upon the arc included between the vertex and a given point, and denominate ϕ the angle formed by the tangent and ordinate, $w \propto \tan. \phi$. If then we assume P A R, fig. 5, to be a parabola generated by the action of parallel forces, we have—

$$\tan. \phi = \frac{NT}{NP} = \frac{2x}{y}$$

But $y^2 = px$, or $x = \frac{y^2}{p}$, and by substitution,

$$\tan. \phi = \frac{2y}{p}$$

$$\text{Hence, } w \propto \frac{2y}{p} \propto y.$$

An attempt has thus been made to exhibit in the most simple and intelligible form, some elementary principles, which must tend to systemize and illuminate our ideas upon the nature and mode of action of the several forces to which a suspension bridge is subject. In the composition of this paper, I am much indebted to a chapter in Poinsot's "Traité de Statique;" but a somewhat different view of the subject has here been taken, and some new matter has also been added, which it is hoped will not be thought uninteresting.

CANDIDUS'S NOTE-BOOK.

FASCICULUS XVII.

> "I must have liberty
> Withal, as large a charter as the winds,
> To blow on whom I please."

I. Much as has been said and written about styles of architecture the Consumptive Gothic has hitherto escaped notice, and consequently animadversion. This must not be confounded with so-called Carpenter's Gothic; for it is frequently correct as to outline, but nevertheless quite otherwise as to execution, the mouldings and details being terribly attenuated, whereby a disagreeable meagreness and insipidity take the place of relief and boldness, and instead of appearing carved, the ornaments look as if they had been stamped with a butter-print. Although its design may be exact as to mere pattern, yet if its mullions and transoms be pared away, as not unfrequently happens, to about half their due proportions, as regards the spaces between the former, a Gothic window becomes deficient in that which gives character to one. Nor is it a little strange that while architects affect as they do, to be scandalized at the slightest deviations from the proportions of Greek and Roman columns, they make no scruple whatever of deviating altogether from those proportions upon which the effect of Gothic architecture very materially depends; but because greater latitude and freedom are allowable in that style, with regard to composition, consider themselves at liberty to disregard what may fairly be called its constitutional principles.

II. Now that Brummagem silver, and other Brummagem productions, are distinguished by the name of 'Victoria,'—which, by the bye, is a most left-handed compliment to her Majesty,—we shall probably ere long have a 'Victorian' style, as well as an Elizabethan one, in architecture. Indeed, such style is now beginning to display itself in the rows of houses rising up about the church at Paddington, which are about the most Brummagem affairs in bricks and mortar I ever beheld. And such enormities are quietly perpetrated before our eyes, while good easy critics are comfortably twaddling about styles. That we should come to such abominations in taste—such frightful barbarisms! Better, infinitely better would it have been to have stuck to the unsophisticated, respectable dullness which stamps all the private streets at the West-end of the Town: inasmuch as the absence of all pretension at design is far more tolerable than design run mad—as we perceive it to be among the Paddingtonians. The name of Wyatt has been mentioned to me—a descendant, I believe, of the illustrious James of 'execrable memory,'—as that of the offender—can it be true? A law, it is to be hoped, will be passed prohibiting foreigners from passing through Paddington, except they be blindfolded. Let the legislature look well to it: for the honour and credit of our beloved country are at stake. Already have we been sneered at—ay, reviled and rated in good set terms by certain saucy foreign critics for our Boz-mania and Jack Sheppardism, which they are pleased to represent as deplorably wretched in taste; and now we shall be [illegible], abused, ridiculed, and made laughing-stocks of on account of our sins in brick and mortar at Paddington—the more suitable name for which would be Madding-town.

---

* See Whewell's Elements of Mechanics.

III. "And how," said I to a German friend, on his return from an excursion to the North of England—"how did Newcastle please you? if there be truth in Dibdin, its magnificence must have enchanted you. Come now, be sincere—put away all your continental prejudices: own that at last you have met with something to match the glories you have left behind you."—"Dibdin be d—d!" was the startling reply: "a man who could write greasy puffs on such a farrago of architectural balderdash, is fit only to be flunky to your George Robins. Dibdin must be an absolute dunce to gabble as he does about the 'Northumbrian Vitruvius,' and cry up as superior creations of art, a parcel of tawdrily bedizened houses, among which there is not one single bit of design to be discovered." "All, then, that is to be said," returned I, "is that we Englishmen do make confounded fools of ourselves."

IV. The only symptom I have yet discovered of the so much talked of March of Intellect, is that there has been no "laying the first stone" of the New Houses of Parliament,—none of the fussy tomfoolery, with the "silver-trowel," and all the rest of it, which generally takes place upon such "important occasions." The sensible example thus set, will, I trust, be adhered to in future; for I suspect the silly ceremony hitherto in vogue, has frequently dipped rather deeply into the building funds—or into funds that might else have been added to them. In truth it is rather provoking to mortal patience to find that while a church or other building is frequently marred and spoiled for the sake of saving a paltry hundred pounds or so, the money can be found forthcoming freely enough for eating and drinking after the august ceremony alluded to—for of course all such recreation must be paid for, though it should amount to double the architect's commission. As to the architect himself, he, poor fellow, is generally a nobody—a mere cypher on the occasion—a creature whom the newspapers do not think it worth while to name: the first fiddle on all such occasions being some bustling body, noble or otherwise, who compliments those around him, and is be-complimented by them as the hero of the day.

V. On the outside of his "Palace of Architecture," Wightwick gives us what he calls a Pyramid of Architecture, the *gradini* or courses of which are respectively inscribed with the name of some high authority in the art, the lowermost being that of Vitruvius, and the topmost that of Hosking. Whether this arrangement was merely accidental, or intended to have some particular meaning, I pretend not to say; but it certainly does look much like assigning the post of supremacy and honour to Hosking that staunch Anti-Vitruvianist, and terrible heretic and unorthodox writer, who has not scrupled to abuse the venerable Vitruvius in good set terms,—and to bring his authority into contempt by asserting that a man might just as well study Geography in Gulliver's Travels, as Architecture in the writings of the great Marcus Pollio.—We here also find placed in friendly conjunction, "cheek by jowl," the names of Britton and Pugin, an association that is almost enough to make the latter start from his grave, for in his life-time the association between them was of the most cat-and-dog kind: nor was P. at all sparing of most highly flavoured epithets towards his quandam co-partner,—of whom by the bye, Bartholomew has just spoken as "the immortal antiquary," and whom he no doubt considers to be a most profound and erudite etymologist also.

VI. "There are thieves and paupers of a very respectable kind in the literary world"!!—So sayeth one—whom I take to be no other than Carlyle, in a recent article on Lessing, in the Foreign Quarterly. How many respectable paupers—that is, very respectable people, yet very *poor creatures*, there may be in the architectural world, it might be dangerous to compute; but with regard to thieves there is no occasion to deny that there is abundance of them; since so far from being at all ashamed of thieving or making any secret of it, the greater part plume themselves mainly upon it, and hold plagiarism to be a proof not only of taste, but of talent. A literary thief—at least a "respectable" one, has generally the grace to blush when his pilferings are detected, and the fine peacock feathers with which, jackdaw-like, he has dressed himself up are plucked from him: not so the architectural one, for he boldly challenges your admiration of what notoriously does not belong to himself, yet in which consists all the design and taste his buildings can pretend to. Originality of any kind,—even that which extends to no more than giving a fresh turn to stale commonplace, is generally disclaimed altogether,—under the trumpery pretence that it is exceedingly hazardous to depart from actual precedent; and so undoubtedly it is for those who have no principles of taste to guide them, and who therefore find it most convenient and politic to decry all attempt at originality as dangerous innovation. Nolumus leges Angliæ mutari is the maxim of our legislators, notwithstanding which they are perpetually tinkering our laws, quashing old ones, and enacting new ones—blundering ones let those say who choose. Why should architects not venture to follow their example?—at all events blunders in taste are not quite so dangerous in legislation.

VII. "Obest plerumque," says the great Roman philosopher, "iis qui discere volunt auctoritas:" which is certainly, unfortunately likewise, most true with respect to architecture, in which a superstitious respect to precedent has impeded the advancement of the art, and hindered that progressive developement which might else take place. Truly fortunate was it for the art that the writings of Vitruvius were not brought to light and studied some centuries earlier, for otherwise the world had, in all probability never beheld that exquisite Gothic style which now enchants us. We of the present day are content to be copyists—to do what has been done before, and nothing more. The consequence is that when we have copied one particular style till we are actually cloyed with it, we go back to some other, not because it is at all better—perhaps not even so good as that we are become sick of: but because it is, at any rate a change. Thus after a most servile and so far erroneous admiration of Grecian examples, we suddenly, with a High Presto! become ardent admirers of Elizabethan architecture, copying all its grotesque whims, its monstrous extravagancies, its absurdities, and puerilities, instead of selecting out its good qualities, and rejecting its vices. But to do this requires more taste and discrimination than fall to every one's lot. Perhaps the recent application of this style to some dashing shops at the West-end of the Town, may help to bring it into discredit for other purposes, and stamp it with the gentility-mongers,—a tolerably numerous class, as vulgar, slow, and of course quite frightful. It happens oddly enough that Wightwick has not given a single instance of this *fashionable* style in his new work, mentioned above in the 5th section of this Fasciculus.

VIII. "The Lord deliver us from patronage," was the half-serious, half-jesting exclamation of one who had had some experience of the pig-headed obstinacy of ignoramusses who, because they hold the purse, fancy their own blundering whims ought to over-rule all other taste. No wonder that poor Peruzzi declined the patronage of Clement VII., who would fain have employed him—not to decorate another Farnesina, but to act as military engineer at the siege of Florence: Such a Mecænas would engage a Ude to cut bread and butter, or one like myself to make a spelling-book. The patronage of the tasteless is the very bane and corruption of art; and the tyranny of those who devote themselves to it in the true spirit of artists. His most gracious Majesty king Midas was a royal patron of the above class; and it is to be regretted that our modern Midasses are not similarly decorated with donkey-ears.

IX. No doubt it will be thought by many that I have already expressed my opinion of Palladio both frequently and plainly enough; but inveterate prejudices are not to be put down by a few blows. They must be attacked again and again, until the mere repetition of the same censures attracts notice, and impresses them on people's attention. I do not pretend to affirm that Palladio possesses no merit whatever, or that he is the worst possible model an architect can follow; yet I certainly do think that he does not deserve to be regarded as a model or authority at all, because there is hardly a vice or solecism which such authority will not be found to justify, if his precedent is considered of any avail. Those whose indolence disposes them to take up with ready-made opinions, which once adopted they do not care to have disturbed, will of course be scandalized at this, and are welcome to be so, in like manner as many would be shocked at what *the* Weber, that is Karl Julius (the most witty and entertaining of all philosophers) has said of the author of Waverley, whom he speaks of as "des zur mode geworden *Vielschmierers*, und düstern Schotten Walter Scott," and *Vielschmierer*, be it observed, is a far stronger term of reproach than our English "Scribbler." Poor Sir Walter! a hundred volumes are, in fact, somewhat too heavy a cargo for an author to venture himself with upon the stream of time, for as Voltaire remarks "on ne va point à la posterité avec tant de bagage."

SUTCLIFFE'S PATENT ROTATORY PUMP AND GENERAL LEWIS.

Sir—The following is a description of Sutcliffe's pump with the result of an experiment on the discharging power of one now at work at the Limerick Docks, where it is found far superior to the chain and sucking pumps before in use. From the facility with which it can be applied in all those cases where pumps are required, and not being subject to get out of repair or choaked, it promises to be soon very generally used, not only in hydraulic works, but also in the navy, and those cases where the common pump was before used for household purposes. The patentee has been almost constantly connected with the execution of extensive works, as superintendant under Sir Thomas Deane and Company, and his attention was directed to the subject by the frequency of repairs required for the pumps usually employed in clearing out water from foundations and dams, their great friction, and the unequal flow of water from them; and I am informed that his invention has received the approval of Mr. Rhodes the engineer, and Sir Thomas Deane and Company, the contractors for the Limerick Docks.

In this pump a vacuum is formed by the revolution of an elliptical frame within a cylinder, when the water rising it is carried round in the lunar space between the ellipse and circle shown on section and discharged.

Fig. 1.

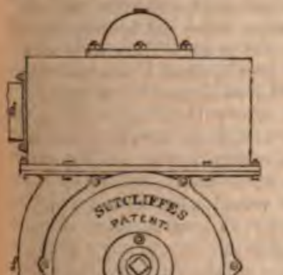
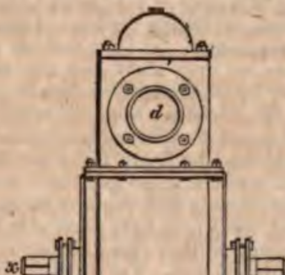


Fig. 2.



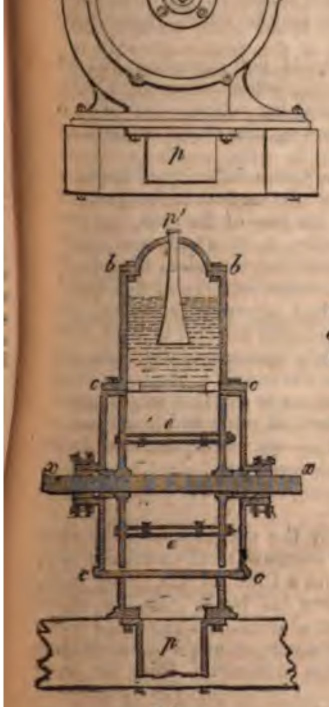


Fig. 3.

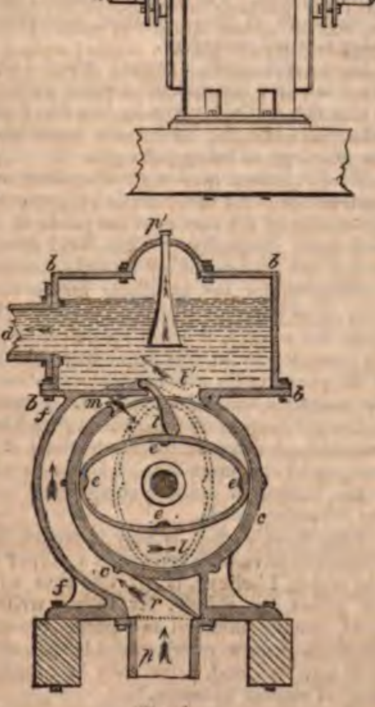


Fig. 4.

In the annexed figures, fig. 1 is a side elevation, fig. 2 an end elevation, fig. 3 a vertical section along the length, and fig. 4 a vertical section across the width of the pump, and the same letters refer to the same parts in each figure; *x*, *x*, the axis by the rotation of which the elliptical frame *e*, *e*, *e*, *e*, is carried round in the direction indicated by the arrow *t*, in fig. 3; *c*, *c*, *c*, *c*, the cylinder in which *e*, *e*, *e*, *e*, moves both, having the common axis *x*, *x*; *f*, *f*, a jacket forming with the exterior of the cylinder a passage for the rising water from the pipe *p*; *t*, and *t'*, fig. 3, two extreme positions of a tongue which hinders the water brought round in the lunes from *m*, of escaping again at the same place, and which keeps touching the surface of the ellipse in its revolution; *b*, *b*, *b*, *b*, a box into which the water is received and discharged through the discharging pipe *d*, and when *d* is closed, forces the water by the reaction of the air above through the forcing pipe *p'*. When the pump is to be used, water is thrown in from above, which renders the contact between the elliptical valve or frame and the cylinder water tight; after a few revolutions the air is exhausted, and the water rising is carried into *b*, *b*, *b*, *b*, and discharged by *d* or *p'* as before described. It is evident the discharge will depend conjointly on the velocity and sectional area of the water passing from the jacket into the lunes, and the area of the lunes and the velocity with which they are formed, or carried round. When the velocity and sectional area at *m* is sufficient to fill a lune in the time of half a revolution, a maximum effect is produced, and the discharge is found; when the velocity at *m* is sufficient to fill the lunes, by multiplying the velocity of the lunes by twice their area of one. The foregoing figures are drawn from a pump of this construction now at work, and are laid down on a scale of 5-8ths of an inch to the foot, but the handles and fly are not shown. Four men discharge 128 gallons through a mean lift of 8 feet 6 inches in 30 seconds, two men working at each handle, and the fly being about 4 feet 6 inches in diameter. It should not be forgot that the facility this construction of pump affords for the application of a fly wheel, affords one though not the first of its recommendations. The water issues in one regular and continued stream from the discharging pipe, chips and clay attached to them when passed into the pump, getting through without injuring the motion or apparently taking from the discharge.

Fig. 1.

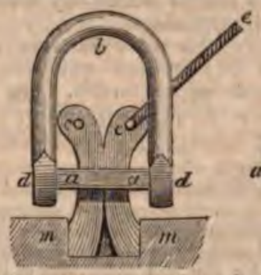


Fig. 2.

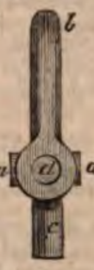
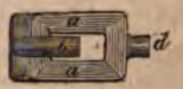


Fig. 3.



The following are sketches of a lewis invented by the same ingenious person, one of which construction is now used in setting the heavy facing to the quays of the before-mentioned docks; some of the stones are 3½ tons in weight. Fig. 1, front elevation; fig. 2, side elevation; and fig. 3, a plan with half the upper ring removed. The same letters refer to the same parts in each, *b* a ring as in the common lewis; *a*, *a*, a collar turning on the axis; *d* and *d*, and *c*, *c*, two pieces inserted into the collar when the lewis is to be used, and also into the mortice, *m*, *m*, in the stone to be set. When the lewis is drawn up, the collar *a*, *a*, presses against the outside sloping shoulders of *c*, *c*, and causes both pieces to approach at top and separate at bottom, thereby pressing the pieces against the cheeks *m*, and *m* of the mortice, by means of which pressure the stone rises with the lewis. The upper portions of c and *c*, are perforated to admit a line being tied to them, and by giving this line, when the stone is set, a few smart pulls in the direction *c e*, the piece *c* is easily drawn up through the collar *a*, *a*, or sufficiently to set the lewis at liberty. This lewis has a great advantage over those in ordinary use, as it is more simple in its construction, and general in its application, than any I have yet seen; it will set at all depths of water with equal ease, and when the stone is set, can speedily be drawn up again. The collar *a*, *a*, and the construction of the pieces *c* and *e*, form the distinctive marks between this and the common lewis. It is similar in its manner of acting to the "Devil's Nippers," but is more extensive in its application. By placing the lewis hole over the centre of gravity of a stone, the stone can be let down to its place with its bed horizontal.

Your's, obediently,
John Neville, C. E.

Limerick, June 1840.

ON OBLIQUE ARCHES.—MR. BUCK IN REPLY TO MR. NICHOLSON.

Sir—After the flourish which has appeared in your last Journal from the pen of Mr. Peter Nicholson, I trust to your candour for the insertion of the following remarks thereon. With them I have sent a copy of my reply to him which was published in the Railway Magazine on the 25th of January last. I have sent it for the purpose of begging the favour of your giving it a place in the Civil Engineer and Architect's Journal, immediately after this, because without it the correspondence is incomplete, and neither Mr. Nicholson's letter nor my observations thereon can be properly understood by those who have not seen the former: and the republication of my letter of that date is the more necessary, inasmuch as Mr. Nicholson in several instances has repeated mistakes which were *satisfactorily* exposed, to every one except himself, in that reply. Relying therefore on your doing so I will proceed.

It may be first proper to state that since my "Essay on Oblique Bridges" made its appearance, Mr. Nicholson has published on the same subject, his "Guide to Railway Masonry," in the commencement of which he has very freely criticised the works of others as well as mine, and if he had done so ably and impartially, I should have had nothing to complain of; but it will be seen by referring to my former letter that he had affected not to have had sufficient leisure to read the work; is it therefore to be wondered at that he should have fallen into errors in criticising it? From the tone of his remarks it is quite obvious that the first and great offence which I have committed in his sight, is the fact of my having published anything on that subject, which he appears to claim exclusively as his own: the second unpardonable offence is the fact of my having, in reply to him, in the Railway Magazine, exposed and refuted the errors into which he had fallen, by putting forth his imaginary "inconsistencies in certain formulæ."

Mr. Nicholson has chosen to sit in judgment upon others and made the preface to his book, where no one could reply to him, the vehicle of his denunciations: and I chose to set the pnblic and himself right upon the subject, so far as I was concerned, by replying to him elsewhere, for which purpose I selected a Journal extensively circulated, and almost exclusively devoted to railway business.

In the latter part of Mr. Nicholson's address, he tells your readers he "has given vent to his feelings at the ingratitude which Mr. Buck has shewn." Therefore, before advancing any further, I beg to observe, I know nothing of Mr. Nicholson except through his writings, I have never seen him, nor have I ever had any correspondence with him except this.

In the introduction to my Essay I made mention of him in the following terms.

"In Nicholson's work on stone cutting, published in 1828, the method of constructing oblique arches with spiral courses is briefly explained, and to it we are indebted for the first principles of the art, but it does not enter sufficiently into detail. Having stated thus much, the author will not hesitate to make use of the principles set forth in that work without further acknowledgement; at the same time it is proper to mention, that the matter which may be found common to both, does not extend beyond a small portion of the first and third chapters of this Essay." Surely any one but Mr. Nicholson would have been satisfied with this.

Alluding to the templates Mr. Nicholson has also given "vent to his feelings," and made use of the following reprehensible language. "Now, Sir, that Mr. Buck should have made these assertions is, to me, a matter of the utmost surprise, seeing that he must have known, when he made them, that he was deliberately stating that which was incorrect."

Here Mr. Nicholson has put himself out of the pale of civilised society, and I most unequivocally repel his accusation, and conscientiously reassert the truth of every word contained in my reply, to which he refers. Mr. Nicholson will be disappointed if after this he looks for very gentle criticism at my hands.

In Mr. Nicholson's letter he has laboured very hard to show that the strictures contained in my reply of last January were erroneous; but I am under the necessity of declaring he has completely failed in the attempt, and moreover that every thing stated by me remains unrefuted, as an attentive reference thereto will make apparent. He has taken especial pains to rebut the following: "this dilemma leads me to infer that Mr. Nicholson is not practically familiar with the subject upon which he has written." And probably it will astonish many when I say that Mr. Nicholson has, but very unintentionally no doubt, confessed that I was correct in coming to such a conclusion; a conclusion at which I arrived from the internal evidence afforded by his writings. He now says in his defence, "I have seen *nine* Oblique Bridges on the Newcastle and North Shields Railway, and *five* on the Brandling Junction Railway, all executed in stone on the principle laid down by me, making, upon the two railways *fourteen* bridges within a distance of about eight miles of Newcastle, and built, AS IT WERE, under my own immediate inspection." This is precisely what I expected; it is a confession that he is "*not practically familiar with the subject on which he has written.*" He "*has seen*" fourteen oblique bridges built within eight miles of Newcastle, and there are thousands of ladies and gentlemen as well as others who can say so likewise.

Mr. Nicholson is highly indignant at my having stated that he adopted from my "Essay," the correct method of showing the joints in the elevation of the face of an oblique arch. Here I beg to observe that the method shown in his work on "Stone Cutting," is erroneous: in his "Guide" he has given that, and added the other which I considered him to have "adopted." No doubt it is just possible he might have found it out by watching the progress of the fourteen bridges which he has *seen* near Newcastle.

Mr. Nicholson exclaims against his having adopted anything as follows: "even if I had been driven to such a strait as to think of, or to stoop to such a thing:" and he also reminds me that "facts are stubborn things." Well, be it so. I think the following is internal evidence afforded by his "Guide," of his having been driven to such a "strait." In my "Essay" reference is made to a line which I have denominated the "*Axial length.*" This term never appeared in any previous work of Mr. Nicholson's, or of any other writer, and I coined the word *axial* to suit the occasion: it is not to be found in any dictionary: but it is found in Mr. Nicholson's recent work, and he has thought proper to insert its signification in his "Descriptive Definitions."

Nearly at the beginning of his letter he says: "I have examined the third chapter of Mr. Buck's Essay, and I can find no method explaining the making of the curved edges of the templates Nos. 1 and 2, plate 26, in my work, to which I refer when I say they are not shown by any other author who has written on the subject: and I have also examined the fifth plate in his 'Essay' which Mr. Buck says contains eight diagrams exhibiting the form of these templates, and I have been equally disappointed, for I can find no such templates exhibited. Mr. Buck does not even show how the radius of curvature of these templates may be found; neither does he give a hint that they are necessary."

Mr. Nicholson appears to state by the above that I have not given diagrams for the *two particular* templates: this is true, because that exhibited by figure 13, in my Essay, and which is very unlike any of his, renders those particular templates unnecessary, and if he were "*practically familiar with the subject,*" he would have discovered that fact, and would have been able to see that it is a much more efficient instrument than those, the omission of which appears to have so much disturbed him. For the same reason I have not shown "how the radius of curvature of those omitted templates may be found," namely, because it is not necessary.

Here I will make a remark which I should not have done had not Mr. Nicholson brought the subject under my immediate notice; and it is that the method given by him for finding the radius referred to is fallacious; but the intolerance manifested by him excludes him from the privilege of being put right.

Mr. Nicholson quotes my statement as to the difficulty of finding a demonstration for the curious property of the mutual convergence of the chords of the curves of the joints of the face of the arch, and then adds most illogically: "This, Sir, I consider to be a sufficient admission of the justness of my remarks, and one which renders it perfectly unnecessary for me to allude further to those remarks at this time." Now it so happens that Mr. Nicholson had never made any remarks upon this subject, it being absolutely impossible for him to have done so, inasmuch as he was previously perfectly ignorant of the facts, and of the property for which a demonstration was sought. He has garbled the quotation and misapplied it. I went on to say that subsequently to the publication of the "Essay," a friend of mine had found one, a beautiful geometrical demonstration; it has not been published however, and I challenge Mr. Nicholson to produce one.

Mr. Nicholson draws a comparison between his work and mine in the following words.

"Mr. Buck's work is only intended for the use of those who may happen to have been trained in a proper course of mathematical study, and which, I believe, is not the case with a tithe of the young men, for whose use chiefly, Mr. B. has written his book. On the other hand, mine is intended as a purely practical work, and as such, I have shown in it how every useful length, distance, or angle of an oblique arch may be found, principally by common arithmetic, from the doctrine of similar triangles."

The young men who are rising in the engineering profession no doubt will properly appreciate the value of the complement here paid to their acquirements by Mr. Nicholson. But I am happy to say that not one with whom I have the pleasure of being connected is deficient of the mathematical knowledge requisite to understand it; indeed, I have in my employ a stonemason, acting as inspector, who makes use of the formulæ, and prefers them to the circuitous and "*clumsy*" rules given by Mr. Nicholson. "Mine is intended as a purely practical work," says he; nevertheless the third part of his "Guide" is headed "Theory of the Oblique Arch." But the fact is, in consequence of his not being "*practically familiar with the subject on which he has written*," his work is altogether *theoretical*, and in some respects very objectionable in practise, which I could easily show, were I disposed to waste my time in doing so.

Mr. Nicholson calls his letter *an address* to me, and concludes it in a dreamy vision of the fame to be awarded to him by "*posterity*," and assuming the motto of the hero of Trafalgar, seems almost ready to exclaim, "Victory, or Westminster Abbey," but to prove how easy is the transition from the sublime to the ridiculous, he closes by saying, "I have now done with him." Very like Nelson indeed!—He fires his pop-gun and runs away!

Your most obedient servant,

George W. Buck.

Manchester, July 18, 1840.

To The Editor of the Railway Magazine.

Sir,—Mr. Peter Nicholson has recently published a work under the title "Guide to Railway Masonry, comprising a complete Treatise on the Oblique Arch." In his preface and introduction he has made some observations and references to a work on the same subject published last June by me, and to which I am anxious of making the following reply, requesting the favour of your inserting it in your valuable Journal.

At page 8 of his preface, in speaking of the forms of the templates which are necessary for working the stones, Mr. Nicholson says, "they are not shown by any other author who has written upon the subject. Now, if Mr. Nicholson will refer to the 3rd chapter of my "Essay," he will find that chapter to be exclusively devoted to an explanation of the method of making the templates and working the voussoirs; moreover, the 5th plate contains eight diagrams exhibiting the forms of those templates.

At page xiv of his "History," at the commencement of the "Guide," Mr. Nicholson says, "The formula $CO=(r+e)\cot\theta\tan\beta$, is due to Mr. Buck. It gives the distance below the centre to the point of convergence, into which all the joints in the elevation of the arch meet in the axis minor, supposing that the joints are straight lines, which they are not exactly; having given the angle of obliquity $=\theta$, and the angle in which the bed lines cross the axis of the cylinders $=\beta$, or the angle which a bed line makes with the adjacent springing line. In this formula also $r=$ the radius of the cylinder, $r+e$ the radius of the extrados, e being the breadth of the bed or thickness of the arch." In reference to this remark. I beg to observe that not only is the *formula* due to me, but so also is the discovery of the beautiful and remarkable property of the oblique arch to which it applies. At page 5 of the "Essay," I stated that the joints of the face "are not straight lines, but curves concave on the upper side": and at page 6 I stated that the *chords of these curves* produced, meet in the point to which I have given the name of the focus of the elliptic face. I no sooner discovered this property than I made it subservient to practical utility, of which any one may be convinced by reference to the "Essay." The stability of oblique bridges is intimately connected with, and dependent upon, this property, and the investigation of the problems relating to the limit of obliquity, and the best proportions for oblique arches, cannot be made without it. At the same page Mr. Nicholson, alluding to myself, writes as follows:—"He says the expression $CO=(r+e)\cot.\theta, \tan\beta$, included among some others, 'are general, that is, they are applicable to segments as well as to semicircles; but in page 9 he gives $\frac{c\cot.^2\theta}{a}(r+e)$ $=CO$, the eccentricity or focal distance below the axis of the cylinder in the oblique segment.'"

This way of stating it will lead any one to the erroneous inference that I have fallen into a discrepancy, and given irreconcileable formulæ. The explanation is as follows: when it is said "these expressions are general, that is, they are applicable to segments as well as semicircles," reference was made to the two formulæ then immediately before given, namely, $CO=r\cot\theta\tan\phi$, and $CO=(r+e)\cot\theta, \tan\beta$.

Now at pages 6 and 7, it is shown that the tangent of the intradosal angle, or of the angle which the bed line makes with the springing line in an oblique semicircular arch, in particular cases, $=\frac{\cot\theta}{\frac{1}{2}\pi}$ and when it has this value, then $CO=\frac{\cot^2\theta}{\frac{1}{2}\pi}(r+e)$. But because, in practice, this value of the intradosal angle ought sometimes to be departed from, then the distance CO may be obtained by either of the two before-mentioned general expressions.

Again, at page 8 of the "Essay," treating of segmental arches, the tangent of the intradosal angle is given $=\frac{c}{a}\cot\theta$; and in this case $CO=\frac{c\cot^2\theta}{a}(r+e)$. But here, again, as before in practice, this value of the intradosal angle ought not to be always adhered to (it requires adjustment to the particular case, as fully explained in the work), and then the distance CO is to be found by one of the two general formulæ before referred to.

Mr. Nicholson's concluding sentence of his "History" is in the following words:—"One thing which we consider defective in Mr. Bucks' 'Essay on Oblique Arches' is, that his instructions are not enunciated under regular heads, so as to call the attention of the reader; he gives no reasons for his rules, nor does he show the principles upon which his formulæ depend. The height of the point CO, Fig. 7, will depend upon the breadth of the bed."

I am really at a loss to conceive what could have induced Mr. Nicholson to make the several incorrect assertions contained in this short paragraph; and to which I shall reply in their order.

First, as to my intentions not being enunciated under regular heads: the table of contents, consisting of the *heads* of the seven chapter into which the work is divided, affords a sufficient refutation to this charge.

Secondly. "He gives no reasons for his rules, nor does he show the principles upon which his formulæ depend." To this it is only necessary to add, that by reference to the work itself it will be evident that the reasons which are geometrical and mathematical, flow naturally from the first principles and contain their own demonstration—the best of all reasons.

Thirdly. "The height of the point 0, figure 7, will depend upon the breadth of the beds." Very profound, indeed! inasmuch as the formula informed him of it, because e in that expression denotes the breadth of the beds.

Mr. Nicholson, at the same page, in speaking of my "Essay," says somewhat affectedly, "*as far as we have had leisure to examine it.*" Surely before any one can be competent to criticise a work he must read it, otherwise he will naturally and inevitably fall into such mistakes as Mr. Nicholson has here been guilty of.

It is not my wish or intention to be drawn into a review of Mr. Nicholson's book, but I think it right to make the following few remarks. In problem 9, referring to plates 28 and 29, he gives directions for radiating the joints of the face of the arch in two different ways. By his first method the joints are to be at right angles to a tangent to the elliptic curve; by the second method they will radiate to the points of convergence, which I have denominated the focus; this latter method is that given by me, and which Mr. Nicholson has here adopted. Now, if the voussoirs be worked in spiral beds, *according to his own rules*, they must necessarily radiate in this way; and consequently they cannot be made to radiate as described in his first method, *unless the beds are worked in some other way, the directions for which he has not given.* This dilemma leads me to infer that Mr. Nicholson is not practically familiar with the subject on which he has written. I have confined myself to the points referred to by Mr. Nicholson's strictures, or I might have added more on the subject.

Here I take the opportunity of saying that after making the discovery of the mutual convergence of the chords of the curves of the face of the arch, and after obtaining the formulæ applicable thereto, I long sought in vain for a *demonstration* of the generality of this property. On applying to my mathematical friends, both in London and Cambridge, I was equally unsuccessful. Under these circumstances, being experimentally quite certain of the existence of this property, I assumed it as a postulate in the "Essay," and the whole of the investigation contained in the 7th, or concluding chapter (*the only part of the work which I consider theoretical*,) is based upon it. The publisher, Mr. Weale, well knows how anxious I was to have given a demonstration in the work, and that I was finally under the necessity of publishing it without, although no one appears to have noticed this deficiency.

However, I have now the gratification of adding that about four months back my highly scientific friend and assistant, Mr. W. H. Barlow, son of Professor Barlow, of Woolwich, has accomplished a beautiful geometrical demonstration, which, in the event of another addition being called for shall, with his permission be given therein, together with some further practical information and additional investigations which I have recently made.

I am, Sir, your's truly,

George W. Buck.

Ardwick, Manchester, January 21, 1840.

MR. BARLOW IN REPLY TO MR. NICHOLSON.

Sir—I perceive in your last number a communication from Mr. Nicholson purporting to be a reply to Mr. Buck, and to the remarks signed W. H. B., which appeared in your Journal for May last. Being the writer of those remarks, I trust you will allow me to say a few words respecting that part of Mr. Nicholson's communication which refers to them.

Mr. Nicholson's observations are chiefly confined to the problem for finding "the curved bevels for cutting the quoin heads of an oblique arch," relative to which I stated that there was considerable obscurity as to what species of joints it referred. He replies, "Now, Sir, I assert that W. H. B. must either have been very inattentive or very stupid not to have observed to what species of joints the problem referred, since every page in which I treat of the oblique arch, has the words 'on the oblique arch with spiral joints,' placed in capitals over it."

Now Sir, I assert that the application of a problem is not determined by the capitals placed over it, but by the principles on which the construction is founded, and this problem is based on the following assumptions, namely, that "the bed and joint lines on the face are perpendicular to the curve which is the intersection of the cylindric surface and the plane of the face," (I quote Mr. Nicholson's own words). Also that the joint lines in the face are straight lines, and that they divide the curve of intersection into equal parts; all of which assumptions are incorrect, and not even an approximation to the truth in an arch of much obliquity, that is to say, with *spiral joints*, while three of them hold good for an arch with *plane joints*, namely, that the joint lines in the face are straight lines, that they are perpendicular to the curve of intersection, and that they divide the curve of intersection into equal parts. I think therefore it will be admitted that there *was* some difficulty in guessing what sort of arch the author wished it to be understood he was referring to. One point, however, the reader may rest quite assured of, namely, that whatever species of oblique arch the problem was intended for, it is about as near the truth for one sort as it is for another, which is an advantage in the construction the public will no doubt appreciate. The fact is, it is only correct for a *square arch*, and the more the arch differs from the square or the greater the obliquity, the greater will be the error in the construction. Mr. Nicholson gives it as a "near approximation," and says that "its simplicity is ample compensation for its introduction;" but if he really is practically familiar with the subject on which he has written, he must be aware that in cases of much obliquity, particularly in arches which are semicircles on the square section, this construction would lead to very great error, and could not be made use of.

The other discrepancies I pointed out in his book, with the exception of two to which he confesses, are only answered by personalities, which may go for what they are worth; it is not my intention to return them in kind, and I can only regret that Mr. Nicholson's resources suggested no other way in which he could reply to my remarks.

I am, Sir, your obedient servant,
WILLIAM H. BARLOW.

Manchester, July 17, 1840.

YORK MINSTER.

SIR,—As no account of York Cathedral has appeared in your valuable Journal since the late lamentable fire, probably your readers may feel interested in the following short notice of its present state, which I am enabled to give from personal inspection. The newspaper accounts have led many to suppose, that the last caused little less destruction than the former fire: but though the damage has been most appalling, this has been by no means the case. The fire did not extend eastward of the central tower, which, together with the transepts, remain entirely uninjured; these portions are now walled off from the nave, ready for the commencement of repairs in that part of the structure. On first catching sight of the exterior, it would hardly be perceived that any fire had ocurred, since the only parts to be observed wanting are the roof of the nave, and the mullions of the top windows in the south-west tower, that in which the fire commenced. The tower has sustained considerable damage, there being, I am given to understand, several large cracks in the masonry; but as the blocks in ancient works are united with a tenacity unknown (?) in modern erections, it can hardly be necessary or expedient to rebuild entirely this part of the edifice. The side aisles are untouched, but the roof of the nave is open to the sky its whole length. Though the heat of the burning timbers must have been excessive, the clerestory windows are perfect, and their stained glass is, I am happy to say, but little broken. The beautiful west window, the glory of its date, remains as before, but the wooden door beneath it was destroyed. The columns and capitals have received less injury than might be supposed, though not one has entirely escaped. The restoration will be attended with little difficulty should the requisite funds be obtained, and it is a matter of surprise that more vigorous exertions, in furtherance of this object, have not been made by the profession, who should look upon the cathedral as their own property. Viewing it in this light, I felt much chagrined at being refused by the dean, though in a very polite manner, the free range of the edifice, having visited York Minster with the express intention of studying closely its decorative and constructive beauties. All true lovers of our noble art must ardently hope the day may soon arrive, when no fee will be required for the inspection of any national monument. Since the former fire, all the screens in the choir have been glazed with plate glass, and the most happy effect in the reflection of the *stained* glass is caused. At Beverley the artist meets with no impediment to the prosecution of his studies, and is allowed to wander about at his will, without the payment of any fee. Perhaps too little care is taken to prevent plunder, and it would be better if a few attendants were stationed about the Minster, who should not, as at Hampton Court, be allowed on any account to exact money. But at York, and indeed at other cathedrals, the choir is kept locked, and you are admitted by the verger; so that sketching, unless you happen to be personally known to the dean, is out of the question. If you think the foregoing remarks worth notice, I shall feel obliged by their insertion,

And am, Sir,
47, *Lower Stamford Street,* Your very obedient servant,
July 20*th*, 1840. A LOVER OF THE BEAUTIFUL.

[The Institute and the Society should endeavour to remove such obstacles as our correspondent complains of, and obtain permission for members of the profession to take sketches and drawings of cathedrals and public buildings.—EDITOR.]

MR. GODWIN'S PAPER ON STAINED GLASS.

SIR—Mr. Godwin has entered with such warmth and energy on the advocacy of the claims which the art of painting on glass has upon us for protection and encouragement, that it is to be hoped he will not allow his efforts to stop where they have begun, but that he will continue to call public attention to the present languishing state of the art, until it appear to be in some degree roused.

There is a further reason for supervision just now, if it be true, as stated in your last number, that the Dean and Chapter of Westminster are about to glaze some of the windows in the Abbey with stained glass. Unless the old method be pursued in the design and execution of them, they may as well put up a few painted blinds, and save the money the glass would cost.

A LOVER OF ART.

REVIEWS.

Second Series of Railway Practice, a collection of Working Plans of Public Works. By S. C. BREES, C. E. London: Williams, 1840.

The success of the first series of Mr. Brees's work called Railway Practice has produced the present continuation, which, although under the same title, is extended to engineering works in general. The present volume is calculated to be of great use, as the author has profited by the experience gained in his former essay, and successfully catered for the wants of the public. Most of the illustrations are from recent works, with the exception of two or three of works by Telford and others, and include, besides railways, the Southampton and Croydon locomotive engines by the Rennies, the swing-bridges at St. Katharine's and the London Docks, and Grand Western Canal, locks on the Forth and Cart Canal, and River Cam, Quay Wall and Coffer-dam of Sunderland Harbour, pile-driving machine at the new Houses of Parliament, &c. The plates are well executed, and exhibit very clearly all the minute portions of the work. Appended to the workf there are several specifications, which form a valuable portion o the volume. The work is one which we can with justice recommend to our readers.

Glossary of Terms in Civil Engineering. By S. C. BREE, C. E.

A dictionary of engineering terms was one much wanted by the student and the public. The architects have had dictionaries for some time, and it was certainly required that the other profession should be as well provided. Mr. Brees's work seems carefully compiled, and is extensively illustrated; as it is not yet in its complete form, and we have had merely the proof sheets submitted to us, we shall defer the farther consideration of it until next month.

Architectural Remains of the reigns of Elizabeth and James 1*st.* By CHARLES JAMES RICHARDSON, Architect, F.S.A., M.I.R.A. Part 2.

This second part is decidedly an improvement on the former one, it contains some very excellent specimens of the style, and will prove to the lover of Elizabethan architecture a rich treat to peruse. We are compelled to defer our remarks until next month, when we shall examine into the merits of the work more minutely. We shall here do no more than remark that the perspective views are treated more tastefully and more pictorially than in the first part. The mansions of Burghley, Kirby, and Agnes Burton, furnish the principal subjects; and whichever opinion may be entertained in regard to their style, several of them are fine specimens of it, and eminently picturesque as compositions.

Treatise on the Theory and Practice of Naval Architecture. By AUGUSTIN B. CREWZE, Member of the late School of Naval Architecture, &c. Edinburgh: Black. 1840.

THIS is a reprint of the article Ship Building, from the Encyclopedia Britannica, and a work well calculated both from that circumstance and its own intrinsic merits to become a popular treatise. Such a form necessarily restricted the author within certain limits, and forced on him the option of neglecting either the theory of his subject, or the constructive portion, and as the latter has been the subject of numerous works, it is less perhaps to be regretted that Mr. Crewze should have chosen to elucidate the general principles of the art, with which he is so fully conversant. The theoretical portion derived from the best authorities, foreign and native, and illustrated from original sources, is perhaps one of the best works to which the student can be referred. The practical part good as far as it goes, is confined in itself, and in the view it takes of the subject, very little being said of steam navigation, and no general account of iron ship-building, steam ship-building, &c. This is to be regretted, for these departments are certainly neither of themselves, nor considered with regard to the future, as the least important branches of naval architecture.

The history of ship-building is sound and good, and is as useful as it is interesting, we cannot however make any extracts from it. The author's observations on the present state of his art, we are also obliged to dismiss thus cursorily, although the subject is one imperatively requiring public attention, and to which the notice of our readers should be directed. This work will doubtless go a great way towards dispelling the ignorance and prejudice which exist on this subject, and towards a reform so much demanded in the scientific department of the dockyards. We think with Mr. Crewze that the tonnage laws and legislative restrictions are the true root of the evil, for otherwise we feel convinced, and we think the history of the art shows it, that our countrymen are not so far deficient but what, as in every other case, they would have distanced their competitors. We are favourable to a restoration of the Naval College, but then it must be an open institution, not a jobbery for a score of cadets, but an establishment where the merchant ship-builder and the artisan may obtain instruction on fair terms. As Mr. Crewze has well demonstrated, nothing has been gained by exclusiveness, and nothing will be gained, so that the sooner the last traces of "the mysterie of shippe buildinge" are got rid of the better. The character of the pupils of the late institution Mr. Crewze has best defended by the proofs he has given in this work of their capacity and attainments; their contributions to the Papers on Naval Architecture, and to the present treatise, would do honour to any profession.

Although this is an elementary treatise, it contains so much valuable matter that we should, if our space permitted, make copious extracts from it; most of the tables for instance are very valuable. Perhaps one of the best specimens will be the following comparison of the technical differences between French and English ship-building, derived from Mr. Crewze's own observations, we are obliged however to omit the illustrations.

> We shall now proceed to notice some of the peculiarities observable in the French practice of ship-building. The characteristic difference in their system from our own, which would strike an observer accustomed to English ship-building, would evidently be a less expenditure of material.
>
> The French have retained the old system of frames and filling timbers. Frequently the frames are close jointed throughout their height, and the filling frames put up as single timbers. The filling timbers are also frequently of fir. Both frames and filling timbers are chain-bolted. There is no shelf under the beams, only a thick clamp, and a wide chock worked upon the short stuff, and up to the beam. There are generally three side binding strakes faced one inch on, and scored one inch over the beams, and bolted together by in and out bolts passing through the water-way, which is also faced and scored in the same manner. These bolts are secured with nuts and screws at the points, on the outside plank.
>
> The water-way is not always scored over the beams, but is sometimes brought plain on their ends. The bolts of the binding strakes, which are then also merely brought on to the beams, secure its lower edge; and in both cases it has in and out bolts through the ship's side, to secure its upper edge.
>
> The method of connecting the beam-ends with the ship's side, which appears to be most generally adopted in the French ships at present, consists of a chock under the beam, securely bolted through the ship's side, the points of the bolts being set up with a nut and screw. The beam-end hooks over the head of this chock. A plate-knee similar in shape to that known in the English service as Roberts' knee is brought on each side against the chock and beam; but these knees, instead of having a short arm against the ship's side for taking in and out fastenings, themselves form the bolt, each knee having an arm which is driven through the side by means of a shoulder worked in the knee, similar to the shoulder of a dog-bolt. The outer end is secured by a nut and screw. The security of the plate-knees to the beam and chock consists only of three screws in each arm, and one screw in the diagonal brace. These screws are not above five inches long. Thus the security of either knee is completely unconnected with that on the opposite side of the beam.
>
> The wales, diminishing stuff, and plank of the bottom, are all treenail-fastened, the buts are secured with two bolt-nails in the timber on which the but is placed, and a through-bolt is driven in the timber next the but. In some instances the plank is nail-fastened, but whether with nails or treenails it is double fastened. The treenails are not caulked on the ceiling, but wedged with conical wedges, Most of the principal bolts, as those of the water-ways and chocks, under the beams, are set up outside with a nut and screw; and great care is taken to omit the fastening of the wales and outside planking, wherever these bolts can be advantageously made to answer as fastenings for them.
>
> There is no regular system observed in shifting the buts of the plank, as there is in the English service; but the planks are worked to their full length, without reference to the shift: the only rule which appears to be observed is, that there shall be about two feet shift between the buts of following strakes.
>
> Rather an interesting experiment as to the possibility of diminishing the scantling of the timber, to any great extent, which is used for building large ships, is in progress in the French navy. The Surveillante, a large frigate, was built wholly of small timber, about ten years ago, and as yet the reports on the system are favourable.
>
> The following is an outline of the plan on which she was built.
>
> The keel, stem, and stern-post are formed of various pieces of timber combined.
>
> The several lengths of the centre piece, or core, are scarphed together, while the side or strengthening pieces only but with plain buts; care being taken that the buts and scarphs give good shift to each other.
>
> There are in this system no other frames than those which form the sides of ports, and the timbers composing these frames are bolted together, without leaving any opening between them, that is, close jointed. The spaces between the frames are filled in with single timbers, or rather with a frame work of timber fitted together.
>
> The cant-bodies are framed as in the ordinary method, the after-body timbered round to the post without transoms or fashion-pieces.
>
> From the main-deck upwards the scantlings of the frames are not different from those of a ship of a similar size built in the usual manner; but below this line there is a very considerable reduction. This reduction commences at the lower edge of the gun-deck clamps, and there a couple of thick strakes are worked up to the lower edge of these gun-deck clamps, to form an abutment for a series of internal timbers, brought on the inner surface of the timbers of the frame, and crossing them at an angle of 45°, the upper ends being placed forward in the fore-body, and aft in the after-body. These timbers but at their heels on the heads of a series of internal floor-timbers, brought on the upper surfaces of the floors of the frame. These internal floors are laid athwartships. The openings between the timbers of this internal diagonal frame are filled in with wedge-fillings, so that the whole hold presents one smooth surface for stowage.
>
> Wherever there is an athwartship bulk-head, there is a system of riders worked on the inner surface of this diagonal frame, but taking a vertical direction. The timbers of these bends of riders are not wrought side by side, but one series of timbers is worked on the inner surface of the other, and the bolts pass in and out through both, and through the bottom. These riders run up to the lower deck, and a beam is so disposed with respect to each bend of riders, as to be secured to their heads, and form a part of the system. The bulk-heads which necessarily fill in the space between the beam and the riders run diagonally up on either side the middle from a midship pillar to the beam and riders. Each bulk-head is water-tight.

It is lamentably true, we fear, that the French are superior to us in many departments of naval architecture, and it is therefore incumbent on all classes interested in the national prosperity to exert themselves to remove the legislative obstacles, which interfere with our progress, seriously injure us at present, and menace ruin for the future. Englishmen only want to be allowed to go in the right way, and not to be forced into the wrong way.

GILDING OF METALS BY ELECTRO-CHEMICAL ACTION.—M. de la Rive has succeeded in gilding metals by means of this powerful action. His method is as follows: he pours a solution of chloride of gold, (obtained by dissolving gold in a mixture of nitric and muriatic acid,) as neutral as possible and very dilute, into a cylindrical bag made of bladder; he then plunges the bag into a glass vessel containing very slightly acidulated water, the metal to be gilded is immersed in the solution of gold, and communicates by means of metallic wire with a plate of zinc, which is placed in the acidulated water. The process may be varied, if the operator pleases, by placing the acidulated water and zinc in the bag, and the solution of gold with the metal to be gilded on the glass vessel. In the course of about a minute, the metal may be withdrawn, and wiped with a piece of linen; when rubbed briskly with the cloth it will be found to be slightly gilded; after two or three similar immersions the gilding will be sufficiently thick to enable the operator to terminate the process.—*Athenæum.*

MR. PARRIS'S DECORATIONS.

A visit to a series of paintings by Mr. E. T. Parris for the decoration of the drawing-rooms at Redbourne Hall, the seat of the Duke of St. Albans, has afforded us more pleasure than we can well express; not simply by the beauty of the paintings themselves and the mind which shines in all, (of which more anon,) but as an indication that decorative art will yet be made to take its proper place in England, and that we may even now triumphantly refute the statement which has been made more than once, that if we need able artists in this department, we *must* resort to the continent for them. England is capable of the highest efforts of art in every branch, if opportunity for the exercise of talent be given, and fair play be but afforded the possessors of it, and we cry shame on those amongst us who would attempt to gainsay it. We shall have occasion hereafter to speak more fully on this head in connexion with fresco paintings, with which it is proposed to decorate the new Houses of Parliament, but at present must confine ourselves to the pictures which have given rise to these remarks. They consist of six large paintings in panels, and a variety of smaller groups and compositions, to fill surrounding compartments. Paintings *à la Watteau*, were the task prescribed to Mr. Parris, and a few rustic beauties and attendant swains beneath wide-spreading trees were all that would have been needed to comply with the terms. With a proper feeling of a painter, however, Mr. Parris has disdained his models, and boldly taken his own path; he has abandoned the constantly repeated nothings of that school, and in their stead, although of course at much greater cost of mind, has produced a series of pictures which all tell a long story of love, poetry, and thought, and are in themselves most elegant and graceful. The subjects are English, French, Indian, Italian, Swiss, and Grecian habits and feelings, each picture being appropriated to a different country, and the manner in which the artist has contrived to convey these is worthy of the greatest admiration and praise. In the panel appropriated to Italy, for example, we have in the foreground of a delicious landscape, music and painting suggested to the mind by a group representing Raphaelle sketching, and the Fornarina, with her guitar, gazing with rapture upon the production of his pencil, while, passing down a ravine at the side, is a peasant woman with a basket of fruit upon her head, in whom is recognized the model of one of the most beautiful works of the divine master. In the Grecian painting we have the sun setting on decaying monuments of the mental energy of her sons when Greece *was* "living Greece" while a modern Greek soldier is listlessly reclining at a well, and inquiring his path of the peasants. We cannot afford space to particularize the whole of the paintings, although each is eminently worthy of a detailed examination; nor can we now venture to add any further remark than that they reflect the highest credit on Mr. Parris as a decorative artist, and will serve to implant a taste and teach to think.

RAILWAY REPORT.

Fourth Report from the Select Committee on Railway Communication.

The select committee appointed to inquire into the state of communication by railways, to whom several petitions were referred; and who were empowered to report their opinion and observations, together with the minutes of evidence taken before them, from time to time, to the house, have further considered the matters to them referred, and have agreed to the following report:—

A considerable number of petitions have been referred to your committee, suggesting the justice and expediency of altering the present system on which railway passengers are taxed.

Much evidence upon this subject was collected by the committee on railways during the last session of Parliament, and your committee have also entered fully into the same inquiry; from both which inquiries your committee are satisfied that this question is of great importance to the public at large, and especially to the poorer classes of the community; and that, in proportion as railway communication is extended through the country, the unequal pressure of this tax will be more severely felt, inasmuch as it will be found to limit the accommodation which railways might otherwise beneficially afford to the labouring classes.

The great advantage which would result to these classes from the establishment of railway communication was repeatedly urged as an argument in favour of these undertakings. To convey the labourer cheaply and rapidly to that spot where his labour might be most highly remunerated, was frequently stated to be one great benefit which would be derived from opening these new channels of intercourse, while it was added that the health and enjoyment of the mechanics, artizans, and poor inhabitants of the large towns would be promoted, by the facility with which they would be enabled to remove themselves or their families into healthier districts and less crowded habitations. Your committee believe that Parliament would deeply regret to find that the tax imposed on railway passengers had a tendency to deprive the labouring classes of these promised advantages, and especially when it is seen that in those parts of the country where the pressure of this tax is most severely felt, the revenue derived from it is insignificant in amount.

The income derived from the duty on railway passengers during the last six years has been, in the years ending

5th January 1835	£. 6,852
1836	8,693
1837	10,296
1838	16,892
1839	39,570
1840	72,716

A reference to the Appendix will show, that of the sum of £72,000 derived from this tax during the last year, £53,000 was received from the five following lines, namely, the Grand Junction, Great Western, Liverpool and Manchester, London and Birmingham, London and Southampton; so that those railways in Scotland and in the North of England which derive their income, as connected with the conveyance of passengers, chiefly from the poorer classes of society, and which suffer most from the present tax, contribute in a very small proportion to the revenue.

The effects of the present system of taxation are very clearly pointed out by witnesses practically conversant with railway communication.

The present duty on railway passengers is fixed by the act 2 & 3 Will. 4, c. 120, which states that "the Proprietor or Company of Proprietors of every railway, along which any passengers shall be conveyed for hire, shall pay for all such passengers at the rate of one halfpenny per mile for every four passengers so conveyed."

Every passenger, therefore, whatever may be his fare, is taxed to the amount of one-eighth of a penny per mile. It is obvious, that while the tax is the same on each passenger, the proportion which it bears to the fares of different classes of passengers must vary considerably. The operation of this tax is well illustrated in the observations of Mr. Smith, the assessor of stage-coach duties: "Suppose a line of 120 miles, and three classes of carriages; suppose the first class fare to be 3d. per mile or 30s., the second class to be 20s., the third class to be 10s., the duty on each passenger would be 15d." This is a large proportion on the lowest fare, and its effect must be to prevent railway Directors reducing their charges for the accommodation of the poorest class of passengers. A comparison of the mileage duty with the fares of different railways will be found in the Appendix, from which it will be seen that the proportion of the mileage duty to the fares on the London and Birmingham is 1-22nd, while on some of the Scotch railways it amounts to 1-10th, and in one case even to 1-6th.

By examining the fares actually paid on different railways, it will be found that, while, in some cases, the first class passenger pays a tax of only 3¼ per cent. on his fare, the third-class passenger is taxed 12, and in some cases 15 per cent.

This inequality of taxation tends materially to diminish the profits arising from the third class passengers, and thereby operates as a discouragement to Railway Companies giving that accommodation which the labouring class might otherwise derive from railways. The real hardship of this result deserves the greater attention on the part of the Legislature, because railway communication has superseded, and in many cases destroyed the conveyance by means of waggons, vans, and carts, which afforded a cheap though dilatory mode of travelling to the labourer and his family. How much the poorest members of society are interested in some alteration of the present duty may be seen by referring to the evidence of Captain Lawes, in regard to the hand-loom weavers, and also in the answers of Mr. Lindsay Carnegie, and other gentlemen connected with the Scotch railways, from whose statements it appears that the tax will, on some of these lines, almost put an end to the passenger traffic, inasmuch as the Railway Directors must raise their fares to an amount which will exclude the chief part of the present passengers from the line. The pressure of this tax is now for the first time felt on many lines of railway; because, in former years, the Lords of the treasury have exercised a power given to them by the act 2 & 3 Will. 4, c. 120, and have allowed many of the Scotch and some of the English railways to pay an annual composition in lieu of this tax; this indulgence, however, which was a great accommodation to Companies opening railway communications in the poorer districts of the country, is now no longer granted, and your committee see many objections to the future exercise of such a power by the treasury.

In considering the question of railway taxation, Parliament ought not to overlook the facts which were elicited by the inquiries of the committee of last session, and which tend materially to increase the objections to a continuance of the present system. It was stated by the chairman and deputy chairman of the Leeds and Selby Railway that, in the year 1836 they raised the fares on that line to an amount which diminished greatly the number of passengers; but they added, that by this increase of fare, although they lessened their number of passengers by 12,000 in the year, yet they augmented their profits by £1,300. Evidence to the same effect has also been given by the chairman of the Bolton and Bury Railway; and a reference to the returns of some of the railways, contained in the Appendix, will further prove the same fact.

Wherever the interests of Railway Proprietors and of the public are at variance, it is probable that the community will be in some degree restricted from the benefits which railway communication is capable of affording; your committee, therefore, believe it to be inexpedient to continue a system of taxation which tends to separate the interests of the Railway Companies and of the public, and which will gradually exclude a great number of persons from the benefit of cheap conveyance.

Two modes of altering the present system of taxation have been proposed, by which the inconvenience above mentioned would be removed.

One suggestion is, to substitute a per-centage on the gross receipts derived from passengers, in lieu of the present tax. The assessor of stage-coach duties, an officer in the department of stamps and taxes, has stated that five per cent. on the gross receipts derived from passengers, would produce about the same amount of revenue as is raised under the present system. This would relieve railways from that inequality of which many complain; and several of the petitions referred to your committee recommend this as the best course which could be adopted.

Another suggestion has, however, been offered to your committe, which would be much more favourable to the interests of the public, namely, to establish a graduated scale of taxation, by which the amount of the tax should be made immediately dependant on the amount of the fare; the great advantage such a system would be that it would act as a check on high fares, and would hold out an inducement to Railway Companies to accommodate every portion of the community.

A scale of graduation has been submitted to your committee by Captain Lawes, which will serve to illustrate this plan. Many Railway Companies are limited by Act of Parliament to a maximum charge of 3½d. per mile for a passenger. Captain Lawes proposes that on all fares exceeding 70 per cent. of the maximum allowed by the act, a duty of 10 per cent. should be levied; on all fares exceeding 40 and under 70 per cent., a duty of five per cent. should be levied; on all fares below 40 per cent. a duty of two and a half per cent. should be levied.

Mr. Wickham, the chairman of the stamps and taxes, stated his objection to the plan to arise from a belief that such a graduated scale would be evaded, and that the revenue would suffer a loss, or at least would not receive the increase which may be expected from a continuance of the present system.

According to the calculation made by Mr. Smith, upon the accounts rendered to your committee by several Railway Companies, it appears that there would be a considerable increase of duty by the adoption of the proposed scale.

Your committee have examined into the different objections urged against a graduated scale, which are, the danger of fraud, by which the revenue might suffer, and the difficulty of collecting duties varying in proportion to the fare.

It is the interest of every Company that all its accounts should be kept in a clear and intelligible form, and in this respect the interests of the Company and of the Government are identical; under a proper system of accounts it does not appear to your committee that frauds could be practised without detection; and the mode of issuing tickets adduced by Mr. Edmonstone, or some similar method, would afford considerable facility for the introduction of a graduated scale of duty.

Your committee do not recommend that the scale proposed by Captain Lawes should be adopted, because they think that the duty of 10 per cent. would be too high; but they would recommend, that wherever no maximum has been fixed by Act of Parliament, 3½d. per mile should be considered to be the maximum, for the purpose of this graduated taxation; and that on all fares exceeding 70 per cent. of this maximum, a duty of 7½ per cent. should be levied; on all fares exceeding 40 and under 70 per cent., a duty of 5 per cent. should be levied; and on all fares below 40 per cent. a duty of 2½ per cent. should be levied. They believe that a scale thus graduated would be found more just than the present system, and that while it would not diminish the revenue, it would afford relief and continued accommodation to the poorer classes of the community.

Your committee would further suggest, that if it be expedient that such an alteration should be made, it is desirable that it should be carried into effect with as little delay as possible, because every alteration in the principle of a tax becomes more difficult in proportion to the extension of the traffic to which it applies; the traffic itself is thereby more deranged, and especially in this case it is expedient that in those districts where railways have been allowed to compound for the existing tax, a substitution to the graduated scale should enable them still to afford accommodation to the labouring class, before they have been induced to abandon their present system of cheap conveyance.

Two other subjects have been incidentally brought under the notice of your committee, on which they are desirous of offering a few observations to the House.

The rapid conveyance of troops from one part of the country to another is occasionally an object of great national importance; and, for this purpose, provision is annually made in the Mutiny Act, whereby in cases of emergency "all justices are required within their several jurisdictions to issue their warrants for the provision not only of waggons, wains, carts and cars, kept by or belonging to any person, and for any use whatsoever; but also of saddle-horses, coaches, post-chaises, chaises and other four-wheeled carriages kept for hire, and also of boats, barges, and other vessels used for the transport of any commodities whatsoever upon any canal or navigable river." Your committee recommend that similar powers should be taken with regard to railway conveyance, on payment of a reasonable sum in consideration of the accommodation required.

It appears that on the Great Western Railway experiments have been made to a considerable extent, with a view of ascertaining the best means of conveying intelligence through the medium of electricity. There is no necessary connexion between railways and this new mode of communication, except that a railway possesses continuity of property between two distant places; and, also, that the numerous servants of an established railway are available to protect the machinery required for the purposes of this communication.

Mr. Wheatstone, Professor of Experimental Philosophy in King's College, has for some years turned his attention to this subject, and has, in conjunction with Mr. Cooke, obtained patents for his inventions. From his evidence, which is especially deserving of notice, it appears that there is no difficulty in conveying intelligence to any part of the island, with an almost instantaneous rapidity, by means of a few copper wires, and small galvanic batteries. There is great ingenuity in the various modes in which Mr. Wheatstone has applied the power of electricity to alphabetical communications, and your committee believe that in a short time further improvements in this mode of intercourse will simplify the machinery, and render the correspondence between distant parts of the island more speedy and certain than by means of such telegraphs as have been usually employed.

Mr. Saunders, the secretary of the Great Western Railway, states the expense of constructing the electrical telegraph on the line of that railway to have been from £250 to £300 a mile. This description of telegraph, however, when once constructed, is worked at a very trifling expense, whereas the telegraph now in use between London and Portsmouth, independent of the original outlay, costs about £3,300 a year, and the lines of telegraphic communication to Plymouth, to Yarmouth, and to Deal, were abandoned in the year 1816, on account of the expenditure required for their maintenance.

Whenever a telegraph shall have been laid down between London and the other ports and mercantile cities of the island, it will give to its proprietors great advantages in obtaining and transmitting information, which must be attended with most important results. For the purposes of the railway itself this telegraph may also be frequently used to prevent the risk of accidents and to obviate delay and inconvenience.

Your committee are of opinion that circumstances may arise in which it may be very inconvenient to leave in the hands of a private company, or possibly of an individual, tke exclusive means of intelligence which this telegraph will afford; and it cannot fail to be of paramount importance that the government should be furnished with similar means of procuring and transmitting intelligence, and they believe that no Railway Company will object on fair terms to give every facility to the government for establishing a line of electrical communication over the whole length of their railway.

Your committee are aware that they have not fully developed the great and increasing importance of this subject, which perhaps does not fall strictly within the terms of the subject-matter referred to them, but they are most anxious to fix the attention of the House and of the public on a discovery which is no less susceptible of useful than of dangerous application.

July 2, 1840.

ADCOCK'S PATENT FOR RAISING WATER FROM MINES.

At the last quarterly meeting of the Manchester Geological Society, Mr. Adcock, C.E., read a paper on his invention for the raising of water from mines and other deep places, and illustrated his subject by numerous diagrams and cards of data, which excited much attention. This invention is unusually novel; it is wholly unlike every thing that has preceded it; and should it answer as well in practice, in the large way, as it appears to have answered in the experiments that have been conducted upon it, it must be regarded as one of the most important and extraordinary inventions of the day, and effect a revolution, as extensive as desirable, in mining affairs. It can be put down, even in the deepest pits, at comparatively little cost, for there are no pumps, no pump rods, no clacks, no valves, but simply one pipe extending to the bottom of the mine or to the sump, and another pipe united with it extending from the bottom of the mine to the top. These pipes are made of sheet zinc, or sheet copper, of the thinnest gauge; and the cost, therefore, when compared with the heavy pump trees now employed, is but of small amount. Wear and tear, comparatively speaking, there is none. We will, however, let Mr. Adcock describe his invention in his own words. He stated that, encouraged by the successes he had experienced in some former attempts to improve pump work, by which he had been enabled to make one valve perform the duty of four clacks, he was emboldened to attempt still further improvements, and eventually proposed to himself the question—"Is it possible, in the raising of water from mines and other deep places, to do without clacks or valves altogether?" He stated he knew this desirable effect could not be produced if the water had to be raised from the mine in a compact or solid state, as in pump work. For in a pit of 1,000 feet in depth, the column of water being also 1,000 feet, the pressure of water against the sides of the pipe at the bottom of the mine would be about 440 lbs. on each square inch, and no pipe that could be conveniently applied in practice could resist that pressure. He, therefore, in the next place, questioned within himself whether the water could not be brought up from the mine in a divided state; and the obvious reply to that question was, if the water be brought up in a divided state, it must be in the state of vapour or of rain. The chain of reasoning, thus far continued, led him, he states, to investigate the descending velocities of drops of rain compared with what those velocities should be by the laws of gravitation; and he found that, by the laws of gravitation, the rain ought

[illegible]

[illegible]

[illegible] the surface of [illegible] engines and [illegible] until the end of the [illegible] withdrawing the fire, the valve [illegible] the defective chamber by the discharge [illegible] should be attached in its stead. In [illegible] one of its tubes become defective [illegible] mechanical communication [illegible] until the defective tube is [illegible] generally occupies three or four hours. [illegible] inconvenience of stopping the train until [illegible] from the next station.

By [illegible] improved boiler no such delay would occur, and the expense [illegible] wages of keeping a number of engines with their fires [illegible] would be avoided, as well as the risk when [illegible] and having another train brought in collision with [illegible] and the lives of passengers and attendants endangered.

The great heating surface obtained in a comparatively small space, is likewise a recommendation to this boiler. It is intended to attach a reciprocating [illegible] can be introduced without [illegible] the fire. The small weight of this boiler in comparison to its generating [illegible] in its favour, for it leaves room for [illegible] without exceeding the present [illegible] of a locomotive.

[illegible] the power—the engines and machinery [illegible].

[illegible] are placed horizontally, and are [illegible] of access, but in this one they are [illegible] the whole of the machinery, pumps, &c., are open to [illegible] for repairs; or any portion [illegible] the engines are working.

[illegible] to a separate crank shaft, and [illegible] to the wheel axle by an endless [illegible] each and which two pullies may be [illegible] diameters, so that advantage may be obtained [illegible] may be required. This arrangement [illegible] instead of cranked, but it also [illegible] accommodation or play, by which all [illegible] are avoided.

[illegible] from such large eccentrics, crank-[illegible] in consequence of the weight of the ma[illegible] straight instead of cranked axles.

[illegible] immediately thrown out, so that [illegible] pumps, and get up the fire, without work[illegible] about to effect these pur[illegible] besides running on the [illegible] The present locomotive need not stir from the [illegible] thrown in, it immediately [illegible]—[illegible] *Railway Times.*

[illegible] ROADS.

[illegible] steam-drag for common roads, [illegible] answered the anticipations [illegible] hours, backing and turning in every [illegible] the various parts in detail. It re[illegible] a speed of about twelves miles an [illegible] pounds upon the square inch. [illegible] steam was observed, while [illegible] when running publicly on the roads. [illegible] which prevents the nervous[illegible] carriages, when the movements of the [illegible] horses show any alarm when [illegible]

[illegible] English company formed for the purpose of working [illegible] about to assemble at Manchester, in [illegible] carriages constructed there: and it is expected [illegible] company will afterwards come [illegible] to form a company, in con[illegible] by means of [illegible] in Ireland as soon as a few of the [illegible] are completed. It is proposed that the English company should, in the first instance, in conjunction [illegible] from Birmingham to Holyhead; the passengers to be thence conveyed by steam vessels to Dublin twice a day; from Dublin to Galway by the steam drags, and thence by steam vessels to New York, touching at Halifax. Thus making Ireland the stepping-stone between England, Nova Scotia, and the United States, and avoiding the de[illegible] and danger of beating up the channel, the most arduous and annoying part of the present route. The whole distance between London and New York will be accomplished, it is expected, in ten days.—*Dublin paper, June 30.*

[illegible] Engraving.—We have received from Dr. Mackenzie, still at [illegible], some further particulars of the interesting process by which Dr. Berres fixes and engraves the Daguerreotype pictures, and also two impressions from such engravings. These impressions are shadowy and very indistinct, but the design is sufficiently made out to justify the hope that further experiments and practice will render the discovery practically available. Respecting the process, Dr. Mackenzie observes, "The proportions are now fixed as follow:—Seven parts of acidum nitricum, of forty degrees of strength, to eight parts of distilled water. With gum arabic the operation is a little longer in being finished, but the picture is much handsomer: without gum it is quicker, but it requires much more care and attention to produce a good engraving. When it happens that the nitric acid produces a precipitate upon the silver plate, *ammonia* must be poured upon the plate, and it will instantly disappear. From time to time it is desirable to take the plate out of the acid and wave it about; thus drying it you perceive better the progress made in the engraving. When the acid becomes muddy it is necessary to change it."—*Athenæum.*

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

ROYAL SOCIETY.

May 14.—Major SABINE, R.A., V.P., in the Chair.

The following papers were read:—

"*Tables of the Variation, through a cycle of nine years, of the mean height of the Barometer, mean Temperature, and depth of Rain, as connected with the prevailing Winds, influenced in their direction by the occurrence of the Lunar Apsides, with some concluding observations on the result.*" By Luke Howard, Esq.

From the tables here given, the author draws the following conclusions: 1st. the barometer is higher under the lunar apogee, than under the perigee; the mean height in the former case being 29·84517, and in the latter, 29,75542. 2nd. the mean temperature is lower under the apogee than under the perigee; the mean height in the former case being 48°·7126, and of the latter, 49°·0356. The mean of the whole year was 48°·7126. 3rd. The rain of the weeks following the apsis exceeds that under the perigee; but with two striking exceptions in the annual result of nine years, the one in the wettest, and the other in the driest year of the cycle. With regard to the winds, the author remarks that those from the north, north-east, and east, prevailed under the apogee on thirty-eight days, under the perigee on twenty-one days; and those from the south, south-west, and west, prevailed under the apogee on twenty days, under the perigee on thirty-eight days. It appears, therefore, that in the climate of London, the moon in her perigee brings over us the southern atmosphere, which tends to lower the density and raise the temperature of the air, occasioning also a larger precipitation of rain. In the apogee, on the contrary, there is a freer influx of air from the northward, a higher barometer, a lower temperature, and less rain; subject, however, to a large addition of rain under this apsis twice in a cycle of nine years, at the times when also the extremes of wet and dry take place on the whole amount of the year.

May 21.—The MARQUIS OF NORTHAMPTON, President, in the Chair.

His Royal Highness Prince Albert, of Saxe-Coburg and Gotha, attended the meeting, signed his name in the charter-book, and was admitted a Fellow of the Society. William Burge, Esq., Walter Ewer, Esq., T. T. Grant, Esq., and Henry Lawson, Esq., were balloted for, and duly elected.

The following papers were read:—

"*Remarks on the Meteorological Observations made at Alten, Finmarken*, by Mr. S. H. Thomas, *in the years* 1837, 1838, *and* 1839. By Major Sabine, R.A., and Lieut.-Col. Sykes; *being a Report from the Committee of Physics to the Council.*"

These observations, made at Alten, in lat. 69° 58′ 3″ north, and 23° 43′ 10″ east of Paris, would seem to have a claim to the attention of the Royal Society, as they offer the *experimentum crucis* of Professor Forbes's empirical formula respecting the gradual diminution of the daily oscillations of the barometer, within certain limit hours, from the equator to the poles. Professor Forbes has laid down an assumed curve, in which the diurnal oscillation amounts to ·1190 at the equator and 0 in lat. 64° 8′ N., and *beyond that latitute* the tide should occur *with a contrary sign*, plus becoming minus. Now, Alten being nearly in lat. 70°, if Professor Forbes's law hold good, the maxima of the diurnal oscillations should occur at the hour for the minima at the equator, and a similar inversion should take place with respect to the minima. Mr. Thomas has himself however modified the value his observations would otherwise have had, by adopting 2 P.M., instead of 3 P.M., for the hour of his observations for the fall; and he has adapted his barometrical observations to a mean temperature of 50° Fahr., instead of 32°. The first year's observations commence on the 1st October, 1837, and terminate on the 30th of September, 1838. The barometer stood sixty-six feet five inches above low-water mark, and the thermometer hung at six feet above the ground; but care was not always taken to prevent the sun shining on it. The mean height of the barometer for the year was 29°·771, and the mean of the thermometer at the freezing point was 32°·017. The maximum height of the barometer was 30°·89 in January, and the minimum 28°·71 in October. The mean of the barometer at 9 A.M. was 29°·764, therm. 33°·455; at 2 P.M. 29°·765, therm. 33°·327; and at 9 P.M. 29°·784, therm. 29°·270. The diurnal observations would seem to support Professor Forbes's theory; but the 9 P.M. observations are entirely opposed to it, as they appear with the same maximum sign as at the equator, whereas the sign ought to have been the reverse; indeed, with respect to the diurnal observations, the mean of five months of the year at 9 A.M. gives a plus sign, although the mean of the year at 9 P.M. only gives the trifling quantity of ·001 plus. There is one remarkable feature in these observations that cannot fail to strike the meteorologist. M. Arago, from nine years' observations at Paris, reduced to the level of the sea, makes the annual mean height 29°.9546; twenty-one years' observations at Madras make it 29°·958; and three years' observations at Calcutta, by Mr. James Prinsep, make it 29°·764; and Mr. Thomas brings out 29°·771. That there should be this coincidence between the observations at Calcutta and Alten is curious. Neither Mr. Thomas nor Mr. Prinsep state whether or not their means are reduced to the level of the sea. It is to be suspected they are not For the next year, that is to say, from October 1838 to September 1839, both inclusive, Mr. Thomas uses a French barometer and French measurements, with centigrade thermometer attached to the barometer, and Fahrenheit's for the detached thermometer. He changes his time of observation from 9 A.M. to 8 A.M., 2 P.M., and 8 P.M., and he reduces his barometrical observations to 0 centigrades. The results of the year are as follows:—mean annual pressures 29°·627; English thermometer, Fahr. 33°·36; greatest pressure in April, least in January!! The mean of 8 A.M. is 29°·620; therm. 33°·75. The mean of 2 P.M. is 29°·631; therm. 34°·73. And at 8 P.M. 29°·631; therm. 30°·75. The diurnal observations assist to support Professor Forbes's theory; but, as in the preceding year, the P.M. observation is at fault; and if the hour had been 9 o'clock instead of 8 o'clock, it would probably have been more so than it appears. The low annual mean state of the barometer for the 1837-8 is even increased in the last year's observations; and as fresh instruments* apparently have been used, there appears some ground to believe that the fact is associated with the locality, and it may be desirable not only to record in the Proceedings of the Royal Society the data already supplied, but to recommend to Mr. Thomas more particular inquiry on the subject. The phenomena of the Aurora Borealis appear to have been observed by Mr. Thomas with great assiduity, and recorded with great care. On examining the register, with reference to M. Erman's important remark, that "in Siberia two kinds of aurora are distinguished, one having its centre in the west, and the other in the east, the latter being the more brilliant." I find that twenty-two nights occur in the course of the two winters, in which the formation of arches of the aurora is noticed and their direction recorded; of these, *ten* are to the *west*, having their centres rather to the southward of west, the arches extending from N.W. to S.S.E. and S.E.; *seven* are to the *east*, or more precisely to the southward of east, the arches extending from N.E. to S.E. and S.W. Of the five others, *four* are said to be from east to west across the zenith, and cannot therefore be classed with either of the preceding, and *one* is noticed generally as being to the north. The facts here recorded appear to afford an evidence of the same nature as those mentioned by M. Erman, as far as regards their being two centres of the phenomena. In respect to the relative brilliancy of the eastern and western aurora, nothing very decided can be inferred from the register. If, as M. Erman supposes, that they may be referred respectively to "les deux foyers magnétiques de l'hemisphère boreal," it is proper to notice that the position of Alten is nearly midway between those localities. There can be no doubt that the frequent appearance of the aurora, and the peculiarities of the phenomena observed there, render it a most desirable quarter for a magnetical and meteorological observatory.

EDWARD SABINE.
W. H. SYKES.

"*Second Letter on the Electrolysis of Secondary Compounds, addressed to Michael Faraday, Esq.*" By J. F. Daniell, Esq.

The author, in this letter, prosecutes the inquiry he had commenced in the former one, into the mode in which the chemical elements group themselves together to constitute *radicles*, or proximate principles. He considers his experiments as establishing the principle that, considered as electrolytes, the inorganic oxy-acid salts must be regarded as compounds of metals, or of that extraordinary compound of nitrogen and four equivalents of hydrogen to which Berzelius has given the name of *ammonium*, and compound anions, chlorine, iodine, &c., of the Haloide salts; and as showing that this evidence goes far to establish experimentally the hypothesis originally brought forward by Davy, of the general analogy in the constitution of all salts, whether derived from oxy-acids or hydro-acids. Some remarks are made on the subject of nomenclature, and the rest of the paper is occupied with the details of the experiments, all bearing on the important subject which he has undertaken to investigate.

May 28.—FRANCIS BAILY, Esq., V.P., in the Chair.

The following papers were read:—

"*Meteorological Register kept at Port Arthur, Van Diemen's Land, during the year* 1838, *and Register of Tides at Port Arthur, from August* 1838 *to July* 1839, *both inclusive.*" By Deputy-Assistant-Com.-Gen. Lempriere. Communicated by Sir John Franklin, R.N.

"*Notice relative to the form of the Blood-particles of the Ornithorhynchus hystrix.*" By John Davy.

A portion of the blood of the *Ornithorhynchus hystrix*, mixed when fresh with a strong solution of common salt, being examined by the author, exhibited a few globules of irregular shape. Another portion, preserved in syrup, contained numerous globules, most of which had an irregular form, but many were circular; none, however, were elliptical, like those of birds. Hence the author concludes, that in form they accord more with those of mammalia.

"*Researches on Electro-Chemical Equivalents, and on a supposed discrepancy between some of them and the Atomic Weight of the same bodies, as deduced from the theory of Isomorphism.*" By Lieut.-Col. P. Yorke.

The author describes various experiments made with a view to determine the electro-chemical equivalents of sodium and potassium. Three experiments gave, respectively, 22·3, 22·9, and 25, as the equivalent of the former; and two other experiments gave, respectively, 45 and 41·7 as the equivalent of the latter of these substances. He then inquires what would be the result of the electro-lyzation of the aqueous solution of soda and potash, on the hypothesis of these bodies being composed of two equivalents, or atoms, of metal, and one of oxygen. To determine this question he employs a solution of dichloride of copper in muriatic acid, as being a substance composed of two atoms of metal, and one of an electro-negative element. Its electrolysis gave as the equivalent of copper, 52·8, 59·4, and 61·6, numbers approximating closely to 63·2, or double the atomic weight of copper. After a long train of investigation, he concludes that there is no reason deducible from the theory of isomorphism for doubting the correctness of the received atomic weights of silver, sodium, &c., but that the difficulty, or anomaly, if it may be so called, should be considered as attaching itself to the di-compounds of copper; and that Faraday's propositions on this subject remain unimpeached.

---

* It appears that the barometer was compared before leaving France, and subsequently to its being taken back to that country.

"*On the Solubility of Silica by Steam; with an account of an experiment on the subject, conducted in the East Indies.*" By Julius Jeffreys, late of the Hon. East India Company's Medical Establishment.

The inner surfaces of a flue built of siliceous bricks appeared to be deeply eroded by the passage over it of steam at a very high temperature, and fragments of siliceous materials laid in the course of the current were partially consumed. A siliceous crust was deposited on several vessels of stone ware, coated with a micaceous glaze, placed in the upper part of the furnace, and this crust was re-dissolved when the vessels were removed to a hotter situation in the same furnace. The author notices the experiments of Dr. Turner and others, which failed in showing the solubility of silica by steam, in consequence, as he conceiyes, of the heat having not been sufficiently great to effect the solution.

INSTITUTION OF CIVIL ENGINEERS.

Feb. 4.—The President in the Chair.

On Steam Engines.

The abstract of Mr. Parkes's communication (*Journal*, No. 31, p. 136,) having been read, Mr. Enys remarked, that Mr. Parkes had adopted a different unit of power to the one he was accustomed to employ; but that was a point on which he was not disposed to insist, and he was prepared rather to yield to Mr. Parkes's opinion where they differed. Agreement on terms was very important, and he wished to see more accuracy introduced in the use of certain terms relating to engines; he would confine the term "duty" to the net work, and the gross work he would call "effect." In speaking of a locomotive engine, he conceived the goods carried to constitute the duty—the whole mass moved, the effect. The duty in Cornwall is a theoretical term, being the water which ought to be raised according to the column displaced, but the whole of which did not reach the surface; and the whole mass of pump work, water, &c., set in motion is the effect. The duty is not commensurate with the effect, as it is independent of friction and other expenditure of power. The pit-work is not always well executed, and is not under the care of the engineer. Duty in Cornwall is, in fact, entirely a commercial question, it having been instituted as a check between the adventurers and the engineer who originally undertook to perform the work of pumping for a certain share of the saving of fuel to be made. There were three distinct causes of improvement in Cornwall, viz., in the boilers, in the application of highly expansive steam, and in the pit work.

Mr. Wicksteed, in reply to a question as to the work now being performed by the engine at Old Ford, stated the general result to be, that with small Newcastle coals of inferior quality, and of such a size as to pass through a screen of three-quarter inch mesh, the duty amounted to 71 millions raised one foot high with 94 lb. of coal. He had experienced great difficulty in procuring good Welsh coal, but with some Merthyr coal he had recently tried, the duty immediately increased to 91 millions.

In the Old Ford engine, the steam is cut off at one-third of the stroke, and the water is raised by the weight of a mass of iron acting on the water at the return stroke. With the ordinary valves there is a loss of about one-tenth, but with the valves invented by Messrs. Harvey and West, used in the Old Ford engine, there is no loss, and no perceptible blow from the water on the valves closing, although no air is admitted beneath.

The speed of this engine varies from one stroke to ten per minute, according to the demand for water. In Cornwall, it is thought that at slow speed there is a considerable saving of fuel, but he is of opinion that there is no difference in duty at a fast or slow speed, provided there is sufficient time for opening and shutting the valves.

As to the term duty, although it is important to know what is the absolute quantity of water raised, yet that is not the whole effect. The engine raises a certain weight of rods, which is its load, and this weight should, in the return stroke, produce a certain given effect in water brought to the surface; but, owing to bad valves, leaks in the pumps, and other causes, the uantity of water raised is not equal to the calculated amount. We cannot ay that an engine has not done its duty because a portion of the water is lost. Two engines, equally good and of identical power, may not produce equal results; because one may be raising water close beneath the beam, another, up a shaft at some considerable distance, by means of a series of long horizontal-motioned pump rods; the latter, again, may be doing a duty of 20 millions in working the pump rods only.

It was his intention shortly to present to the Institution a complete report of the work done by his engine, with drawings of every part; but he was waiting to have the opportunity of ascertaining the evaporation from the Cornish boilers, as well as from those of a pumping engine of Boulton and Watt's, also in use at Old Ford, so as to determine, at the same time, the respective duty and consumption of steam by the two engines.

Mr. Field insisted on the importance of distinguishing between the duty and effect, by using the former term for the water actually raised, and the latter for the real power expended. He understood these terms to be so applied to engines for water works in London, and that effect included the friction of the water in the pipes, and all other causes of diminution of duty. The real effect should be ascertained from the pressure of the water at the pump, as determined by a mercurial gauge. It is generally understood that, in speaking of the real comparative effects of the water works engines in London, it would be unfair to take the water raised, as the same power would in one case be expended in raising water 100 feet, as is expended in another case in raising water 200 feet. The pressure of the water at the pumps is the proper standard of comparison.

Mr. Parkes stated, that in his paper he had used the term duty as distinguished from the absolute power of the engine. The same Cornish pumping engine at different periods performs very different amounts of duty, although the absolute power exerted by the steam is the same. This arises from additions to the friction by new pump rods, and from other causes. The Cornish result is below the real duty done by the engine, taking the term in their acceptation of it, and using their mode of calculation for that which is by them considered a purely commercial question. The only correct manner of ascertaining the absolute power exerted by pumping engines, so as to compare them with rotative engines, is to take the pressure on the piston, and the value of the vacuum on the other side at the same time. The term duty expresses the true, useful, or commercial performance of the engine, but is no measure of the absolute power of the steam, which has to overcome the friction of the engine, pumps, rods, &c., in additiou.

Mr. Enys, in reply to a question from Mr. Gordon as to the speed at which an engine is worked with the greatest economy, stated the general opinion in Corwall to be in favour of about 9 strokes per minute; if there was a pause of half a second between each stroke, the Cornish engineers were perfectly satisfied. The indoor stroke is usually at the rate of from 250 to 260 feet per minute, and the outdoor stroke about 140 feet. When the number of strokes exceeds 9, the balance requires to be altered; the engine then runs out quicker, but requires a greater expenditure of steam to bring it in again. In answer to a question relative to Woolfe's engines, he believed they had never had a fair trial, as all the boilers originally adapted to them were much too small, and the tubes soon got full of oxide and mud; if the present system of Cornish boilers had been in use at the time, he thought they would have acted mnch better. Some engineers are so much impressed in their favour, that they are desirous of giving them a trial again with all the recent improvements.

Mr. Cottam mentioned an engine on Woolfe's principle which had worked perfectly well for several years. It is now grinding a bushel of corn with a fraction less than 4 lb. of coal. The pressure of the steam in the boiler is from 22 to 25 lb.

Mr. Cottam, in reference to the above discussion, at a subsequent evening (Feb. 18) alluded to the pumping engiue at Hammersmith, which forces the water through five miles of pipes, and then through a vast number of smaller pipes, and was subject to great variations of service, and inquired how the duty could be ascertained with any tolerable accuracy, as the variable expenditure of steam under different circumstances must lead to considerable errors. If a boiler, as in the Cornish engines, is adapted to raise the bob 7 times per minute, and, owing to some cause, as the water not being able to get away, the bob is raised only 5 times per minute, there is two-sevenths in favour of the boiler; or if an engine adapted for 30 strokes per minute makes only 25 occasionally, there is great difficulty in comparing it with other engines.

Mr. Donkin urged the necessity of keeping the quality of the engine and its commercial effect perfectly distinct; if a given weight be raised to a given height, it must produce a given effect minus the friction; in water-works engines the resistance opposed by the friction is very considerable, and being very variable, it must not be allowed to interfere with the consideration of the intrinsic quality of the engine; of two engines having equal power, one may discharge, owing to these circumstances, more water than the other, but if both be of the same construction and raise a given weight, whether the water be discharged perpendicularly or forced through any length of horizontal pipes, there can be no mistake as to the amount of the effect produced, or, in other words, of duty performed, as that would be determined by the weight raised if in a Cornish engine, or by the resistance overcome if in an ordinary pumping engine.

Mr. Wicksteed observed, that there was no difficulty in instituting a comparison between the duty of a Cornish engine and of an ordinary water-works engine, because by the former the water was raised through a perpendicular shaft, and by the latter forced through several miles of pipes, of varying length and resistance. He had for several years ascertained, by means of a mercurial syphon gauge, the pressure at the pump piston, and this gave, with perfect accuracy, the resistance overcome by the engine, whether arising from the pressure of water raised to a given or varying height, or from the friction in a great length of pipes. This was easily proved at Old Ford, where the water was raised into a perpendicular column or stand pipe, in which the level of the water would be that necessary for overcoming the resistance opposed by the pressure and friction. In making comparisons between the common water-works engine and the Cornish, this was the mode he had adopted, and he believed it to be the only fair one. He had proved the accuracy of the mercurial gauges by the measurement of the column of water supported. The Cornish engine at Old Ford acts by raising a weight of metal, which, upon its return, raises the water. This is the only engine in London of the kind, and to establish a comparison between it and any other pumping engine, it is only requisite to apply a mercurial gauge as just described to the pump of each, and whether the water is lifted direct or forced through any length of pipes, the resistance or load against which the steam acts will be shown. Previously to his Cornish engine being set to work, the beam and plunger were balanced with the greatest accuracy, and their preponderance ascertained before the steam piston and plunger were packed. The weight afterwards added to the pump end was also carefully ascertained. The weight raised at each stroke of the engine is thus accurately known. The number of strokes performed in a given time is registered by the counter. The coals are carefully weighed. By ordinary attention, the boilers are so managed with regard to the work to be done, that no steam is allowed to blow away, whether the engine be making 3 or 9 strokes per minute; and in calculating the duty done by the quantity of coal consumed, no deduction is made for stoppages. Thus, a certain number of strokes being made, a known weight has been raised to a given height a given number of times by the consumption of a known weight of coals. This engine worked under the pressure of a column of water from 110 to 116 feet in height, and the water was forced through 300 miles of pipe, varying from 42 inches to 3 inches in diameter. The load at the pump in the common pumping engine is ascertained by the same means, and no error can exist in determining the duty performed by each.

Mr. Parkes observed, that the term duty did not seem to be quite understood; duty was not the weight of water raised 1 foot in height, but that weight divided by a bushel or other measure or weight of coals also; that the time in which the water was raised did not enter into the computation of duty, though it did into the determination of horse power. He would again call attention to the fact, that coal was no measure of power or of the quality of an engine; that one engine might be doing more duty than another, because it had better coal or better boilers; and that the only standard of perfection between different engines was the relative consumption of water as steam for equal effects.

Feb. 11.—The PRESIDENT in the Chair.

The following were balloted for and duly elected:—John Green, John Hartley, as Members; Joseph Woods, Frederick Rumble, as Graduates; Oliver Lang, John Grantham, Capt. George Smith, R.N., Lieut. E. N. Kendall, R.N., as Associates.

"*A Description of the Coffre Dam at the site for the new Houses of Parliament.*" By Grant S. Dalrymple.

The works described are those which necessarily precede the erection of the main building. They consist of the coffre dam, river wall, and the foundations of the river front—according to the designs, and under the direction, of the engineers (Messrs. Walker and Burges) and Mr. Barry, the architect; the whole being executed by Messrs. Lee, the contractors.

The mud at the site of the works varied much in depth and in consistency, but beneath it is a bed of red gravel and sharp sand, averaging 14 feet in thickness, laying over a stratum of stiff clay, into which the piles are driven to a depth of 2 feet. To facilitate the driving of the piles, a curved trench, 27 feet wide by 8 feet deep, was dredged in the line of the dam. The main piles of Memel fir, 36 feet long by 1 foot square, were then driven, leaving their tops 4½ feet above the Trinity high-water mark of ordinary spring tides. The waling pieces were then attached, and the outer sheet piles of whole timber, 36 feet long by 13 inches square, sawn square on all sides, so as to ensure the joints being close when driven and bolted to the waling. The inner sheet piles of half timber were then driven to the same depth as the others; the space above them was made up with horizontal pieces, bedded down to them, and secured with bolts to the furring pieces inserted above the waling at each gauge pile. The whole length of the dam was secured by diagonal braces, extending back to the old river wall, against which they were abutted. The outer and inner rows of piles were secured together by three rows of wrought iron bolts, the lower being 2½ inches diameter, and the two upper rows 2 inches diameter. The whole of the piles being driven, the space between was cleared out down to the clay substratum, and then filled up with stiff clay mixed with a portion of gravel; a portion of the excavated matter was then laid on both sides of the dam to protect the piling from injury.

The first pile was driven on the 1st of September, 1837, and the dam was closed on the 24th of December, 1838. The extreme length of the coffre dam along the river face is 920 feet, and the ends return at an angle until they meet with and enter the old river wall, at a distance of about 200 feet from the face of the dam.

The excavations for the foundation of the river wall were got out in lengths of 50 feet, levelled to receive the footing courses, which were laid on a bed of concrete of a thickness varying from 1 foot at the north end to between 5 and 6 feet in the centre and south corner, where the substratum was loose and spongy. The concrete was composed of 6 measures of gravel and sand to 1 of ground lime from the lower stratum of the chalk formation. Along the face of the wall was driven a row of elm sheet piles, from 8 to 12 feet long by 8 inches thick, square sawed, so as to drive close, spiked to an oak wale, and the whole secured to the front by 1-inch wrought iron bolts, placed at distances of 4 feet apart, stretching back 6 feet into the wall, and fixed by cast iron washers bedded between the footing courses. The two bottom or footing courses of the wall are 11 feet wide, of York landing, 6 inches thick; on these are two courses of Bramley-fall stone, each 1 foot 3 inches thick, from which rises the stone facing of the wall, of Aberdeen and Cornish granite, in courses varying in thickness from 2 feet 2 inches at the bottom to 1 foot 7 inches at the top. The front is built to a curve of 100 feet radius, and is backed with brickwork, making the total thickness of the wall 7 feet 6 inches at the bottom, and 5 feet at the top. Counterforts, projecting 3 feet 4½ inches by 3 feet 9 inches wide, occur at intervals of 20 feet along the whole length. At a distance of 28 feet 9 inches from the back of the river wall is the foundation of the front wall of the main body of the building, the space between the two walls being filled up with concrete, composed of 10 parts of gravel to 1 part of ground lime. The total length of the river wall, at the present level of 2 feet 3 inches above the Trinity standard of high-water mark, is 876 feet 6 inches. The wings at each end, projecting 2 feet 3 inches before the face of the centre part, are 101 feet 6 inches long each, leaving a clear terrace walk, 673 feet 6 inches long by 32 feet wide, between the wings and fronting the river. The height of the wall from the bottom of the footing courses is 25 feet 9 inches.

The excavation for the wall was commenced on the 1st of January, 1839, and the building of it was commenced in March of the same year. The amount of the estimate for the dam and wall was £74,373.

"*On Browne's Patent Hydraulic Level.*" By A. T. HEMMING.

This instrument, designed for ascertaining the relative heights of points not visible from each other, consists of lengths of water-tight flexible tubing, attached to each other by brass joints, and having glass vessels at each end. The vessels and tubing being nearly filled with water, the level of the water, as seen in these vessels at two points whose relative heights are to be compared, will serve to indicate their positions, whatever may be the inflexions of the tubing betwixt the two vessels. Graduated rods are placed perpendicularly at the points of observation, and the lower vessel is raised, and the higher lowered, until the level of the fluid therein intersects the graduation of the rods. It is conceived that this level may be peculiarly useful in mines and excavations, and in fixing complicated machinery.

Light for Light-houses.

Captain Basil Hall briefly explained his views as to obtaining for lighthouses all the advantages of a fixed light by means of refracting lenses in revolution.

The difference between a fixed and a revolving light is much in favour of the revolving light, as the light can be concentrated and great brilliancy obtained on any particular point at each succeeding flash;—by a fixed light being meant one in which the light is visible on every side; and by a revolving light, one in which the light appears in periodical flashes. Fresnel's fixed light has only one-sixth the brilliancy of his revolving light. Fresnel's system consists in having a large central lamp with four concentric wicks, surrounded by eight lenses, each three feet diameter. The light is thus concentrated and thrown off in eight pencils, which, as they strike the eye successively, have very brilliant effect, and are visible at a great distance.

Captain Basil Hall's inquiries have been directed to ascertain whether the well-known superior brilliancy of a revolving light could not be obtained for a fixed or continuous light; that is, for one equally visible in all directions at the same moment. His idea was, that by giving a certain velocity of revolution to a series of lenses round a fixed light, as in Fresnel's arrangement, a continuity of illuminating power, equal almost in brilliancy to that of a slowly revolving light, might be produced. This, he expected, would prove true, provided no intensity were then lost. He had erected some apparatus at the Tower, and determined the effect by experiment. The apparatus consisted of a fixed central light with a series of eight lenses, 1 foot diameter and 3 feet focal distance, so arranged as to revolve at any velocity up to 60 revolutions per minute. The light from the central lamp being concentrated by refraction through the eight lenses into eight pencils, having a divergence of about 8° each, illuminated not quite 50° of the horizon when at rest; but when this same system of lenses was put into rapid motion, every degree of the 360° of the horizon became illumined, and to spectators placed all round the horizon, the light would appear continuous and equally brilliant in every direction. The only question would be, whether or not this continuous light is essentially less intense than the light seen through the lenses at intervals when in slow motion. The fact is, that two distinct effects are produced in this experiment—a physical effect in diminishing the brilliancy of the light exactly in proportion to the ratio of the dark portion of the horizon compared to that of the enlightened portion, viz. as 310° to 50°; and a physiological effect (suggested by Professor Wheatstone), by which the sensibility of the retina might be so excited by a succession of bright flashes, that not only a continuity of light might be produced, but a light not much, if at all, inferior in intensity to that caused by the lenses at rest. When first set in motion, the effect is that of a series of brilliant but trembling flashes; as the system of lenses is accelerated in velocity, the steadiness of the light increases with scarcely any apparent diminution of brilliancy. At 44 revolutions per minute absolute continuity is produced, and at 60 revolutions nearly the steadiness of a fixed light. When viewed from the distance of half a mile, the effect is nearly that of continuity, very much resembling that of a fixed star of the first magnitude. The only difference in the quality of the light is, that the lenses being in motion, it resembles a star twinkling violently; and when at rest, it resembles a planet. The difference of intensity had been measured by examining the light through a number of plates of stained glass. Some eyes had seen the light through 13 glasses, the lenses being at rest—and through 12, the lenses being in motion; other eyes with other glasses had seen it through 10, the lenses being at rest—and 8, the lenses being in motion. He had seen it through 9, the lenses being in motion, and through 10 at rest. He did not pretend to say whether mechanical difficulties might not prevent the adoption of the system; what he aimed at was to establish the principle, that by putting a system of lights into a rapid rotary motion, a continuous light visible in all directions would be the result, without any essential diminution of brilliancy, as compared to that of the same lights when viewed at rest. If this principle should prove correct, its application to practice might afterwards be thought of, and left to the ingenuity of the engineer; but if the principle should not be correct, and there was a great loss of light by the rotary motion, then it would be useless to go on.

At the subsequent meeting, Feb. 18, Mr. Parkes observed, that he could entirely confirm the account of the experiments with revolving lenses given by Captain Basil Hall on a preceding evening. It appeared to him, that when the lenses made 32 revolutions, the light was not quite continuous; but at 40 revolutions it was perfectly so, although the general effect was twinkling. The central spot was very distinct; he saw the light equally as distinctly through 10 coloured glasses, the lenses being in motion, and through 11, the lenses being at rest. He would suggest, whether the tremulous appearance of the light might not be in part accounted for by the slightness of the revolving frame, which, at the required velocity, vibrates considerably. In the temporary apparatus erected at the Tower, one man could maintain about 40 revolutions per minute.

Mr. Alexander Gordon remarked the coincidence of the experiments of Captain Basil Hall with a law of light as laid down by writers on optics,—viz. that if a luminous body pass the eye eight times in one second, the impressions are blended so as to produce the appearance of continuity, or that the duration of an impression on the retina may be taken at about eight seconds. Now, in the apparatus erected by Captain Basil Hall, there are eight lenses, and continuity of light is produced when the frame makes 60 revolutions a minute. Thus, eight lenses flash across the eye in one second, and the observed result is a remarkable confirmation of the law alluded to.

Mr. Hawkins thought the light was better and steadier at 40 revolutions than at any other speed. When observing the reflection of the light on the features of the by-standers, he saw them very distinctly, the lenses being at rest; but from the moment of commencement of motion, there was a visible diminution in the intensity of the light, which increased with the speed. He saw the light, the lenses being at rest, through 10 coloured glasses, and through 9 when in motion.

Mr. Macneill thought the light was steadier at 60 than at 40 revolutions. The shadow was less intermittent. He did not conceive the mode of examining the intensity of the light through coloured glasses to be so correct as by observing the depth of the shadow, as the eye was capable of judging more correctly of the relative intensity of shadows than of lights. When the lenses were in rapid motion, there appeared a dark spot in the centre of a luminous disc.

Professor Keating, of Philadelphia, stated that the dark spot in the centre appeared as if he saw the wick of the lamp. The lenses being at rest, the light was uniform; but on their acquiring a certain degree of velocity, its whiteness diminished; until at 40 revolutions a decided orange tint appeared, and at 60 revolutions both the orange hue and the centre dark spot increased.

Mr. Lowe inquired whether the quantity or intensity of light was most required for lighthouses. The conflicting opinions of experimenters on the intensity of light, as ascertained by the photometers now in use, show that some better test or means of comparison is wanted. He should conceive that pieces of coloured glass could not afford any accurate measurement of the space-penetrating power of light at so small a distance as 345 feet, which he understood was the length of the room in which these experiments were tried. The depth of shadows also furnished no adequate measure of the intensity of light, for shadows were differently coloured for different lights. Perhaps the photogenic paper might furnish the tests and means of comparison now so much wanted.

The President remarked on the advantages of the revolving lights, as apart from the greater brilliancy, in that they are peculiarly useful as being easily distinguished from land and other lights, which tend to mislead mariners. There may be peculiar advantage in the tremulous character of Captain Basil Hall's light, as enabling it to be more easily distinguished among others. It is not simply the quantity of light which is diffused over the horizon which is valuable, but the intensity of the ray in a certain direction, which, falling on the eye, rivets immediate attention.

Feb. 25.—The PRESIDENT in the Chair.

The following were balloted for and elected:—William Reed, Captain Andrew Henderson, Edward Oliver Manby, William Johnson, Alfred King, and Gustave Holtze, as Associates.

"*On the Improvement of Navigable Rivers, with a Description of a self-acting Wasteboard at Naburn Lock, on the River Ouse.*" By Henry Renton, Grad. Inst. C. E.

Previously to the year 1834, the navigation of the River Ouse from Selby up to Boroughbridge, a distance of 39 miles, was much impeded by a number of shoals or "huts," some of them of considerable extent—all vessels drawing more than 5 feet water being compelled to await until the spring tides set in, so as to afford them sufficient depth of water. Mr. Rhodes was consulted as to the best mode of obviating this difficulty. He recommended the employment of a steam dredging-machine to deepen the bed, by removing the shoals, and the construction of a self-acting wasteboard on the dam, so as to give an additional height of water between Naburn and Linton Locks, as it was found that no injury could occur in the adjacent lands from the level of the river being raised 18 inches.

The greater part of the shoals consisted of compact blue clay, with a mixture of gravel and large boulder stones, and, in a few instances, of oak trees, such as are found near the bottom of bogs.

To use the dredging-machine in the most advantageous manner, the principle of the sliding tool in a turning lathe was adopted, by running the machine across the face of the shoal from side to side of the river, without altering the position of the lower tumbler. This method produced a perfectly even horizontal surface of the bed, and prevented subsequent accumulation. The whole of the shoals were thus removed, so that sea-borne vessels and steamers, drawing from 11 to 12 feet water, could at all periods navigate to York, a distance of 80 miles from the Humber. It was still necessary to raise the height of the water at least 18 inches between Naburn and Linton Locks, to enable vessels drawing 7 feet water to pass at all seasons from York up to Boroughbridge, a farther distance of 20 miles. To accomplish this, the self-acting wasteboard was constructed.

It is composed of two distinct boards of Memel timber, each 76 feet long, 18 inches high, and 4 inches thick, placed on the top of the angular face of the dam. It is fixed by means of strong wrought-iron hinges, leaded into the stone work at intervals of 10 feet. Over the hinges are fixed wrought-iron bolts, 1 inch diameter, connected by flat chains with the plimmer blocks on a line of shafts extending behind each board on the face of the dam; on the ends of these shafts are fixed spur-wheels working into pinions which drive pulleys, over which run the chains supporting the balance weights, which are hung on the face of the wing walls. When the balance weights are at the bottom of the walls, the wasteboard will be in an upright position, which occurs when the surface of the water does not rise 6 inches above the top of the boards or 2 feet above the dam; but when, on a sudden increase of the volume of water, there is a considerable pressure on the face of the wasteboard, it more than counterbalances the weights, and causes the boards to incline towards a horizontal position, at the same time raising the balance weights and allowing a free passage for the water. When the pressure diminishes, the weights descend and the boards resume their vertical position.

The time occupied in dredging the river and constructing the wasteboards was two years, and the cost of the latter, which was made by Messrs J. and W. Lailder, of York, was £300.

The result of these alterations has been most satisfactory, as, since their completion, not a vessel has been detained in the upper level, and the registers of the heights of the water at Linton and Naburn Locks and York show, that the winter floods have not risen to such a height, or continued for so long a period, as previously to the improvements being carried into effect.

"*On the autogenous uniting of Lead and other metals.*" By M. Delbruick.

The term "autogenous" is employed by the inventor, M. de Richemont, of the method now described, to designate the union of pieces of metal of the same kind with one another, without the intervention of the ordinary alloys of tin or other connecting medium. This is effected by directing, by means of a fine beak, the flame of a jet of hydrogen on the parts to be united. A complete fusion of the metal is thus effected, and the parts are united in one homogeneous mass, the metal at the points of junction being in the same state chemically as at the parts untouched. Plates of any thickness, whatever the direction of the edges to be joined, may thus be perfectly united, and the lines of junction made as strong as the rest of the mass. Many circumstances contribute to render the joints made with common solder objectionable. The rates of expansion and contraction on changes of temperature for lead and its alloys with tin are different; some chemical agents act much more on alloys of lead and tin than on lead alone. The alloys also are fragile, and the solder may not perfectly attach itself, without the imperfection being observed. In addition to obviating these objections, M. de Richemont conceives that his new method or union possesses the farther advantages of economy, in saving of solder and in avoiding seams and overlappings; in permitting the use of thinner lead and the use of lead where it is now inadmissible, and in rendering practicable the repairs of vessels which are now impracticable.

M. de Richemont also applies this jet of flame to heating the common soldering irons used by tinmen and plumbers. The jet is permitted to play upon the tool, which, in a few seconds, is brought to the requisite heat, and maintained at that heat without any injury to the tool. The heat can be regulated to the greatest nicety by diminishing or increasing the jet. The author conceives that the sulphate of zinc produced in the manufacture of the gas will be found of such value as greatly to diminish the cost of this process.

ROYAL INSTITUTE OF BRITISH ARCHITECTS.

The closing meeting of the Session of the Institute of British Architects was held on Monday evening, the 13th of July. The chair was taken by the President, Earl de Grey, who was supported by a numerous attendance of the Members of the Society and their visitors.

The proceedings of the meeting derived a peculiar interest from the presence of Mr. Morrison, of Dublin, Vice President of the lately established Institute of Irish Architects, who was announced as the representative of that body; Mr. Morrison is also a Fellow of the Institute of London, and the present occasion being the first on which he had attended since his election, he was admitted in due form by his Lordship, who then addressed him as follows:—

Mr. Morrison, I assure you that I am extremely happy at being able to attend here to night as President of this Society, to receive you as the representative of the Royal Institute of Architects of Ireland. We have the same feelings and views as yourself and your colleagues: namely, to promote the arts essential to the profession, and at the same time to elevate the character of the Professors themselves.

It will be remembered by many of those who hear me, that your Society when first projected, was intended to form a branch of our own. The wording of our charter, or some technicality, combined with the distance by which we are separated, rendered it impracticable to effect that union. But though we were thus forced to adopt separate names, we coincide and unite in one common feeling; and I do not hesitate to say that by co-operation we can always mutually be of service to each other.

The utility of such an institution is I think obvious. The benefit resulting to the profession is not confined to any particular portion of it; the juniors as well as the seniors profit by it; for at the same time that the junior members are thereby furnished with opportunities of hearing the opinion, and acquiring information from those who are of longer standing than themselves, it is by no means devoid of utility to the seniors by inducing them to communicate amongst one another the result of their more extended experience. The Association of the Honorary Member is not without its utility. It affords to us, who were not educated for the profession, an opportunity of becoming acquainted with many of the most eminent men in the various branches of it, whilst, we in return, may occasionally have it in our power to assist them, by affording a facility of meeting with persons, and assembling at places which they might not otherwise have an opportunity of doing. With this feeling I accepted with readiness and pleasure the complimentary offer from the Irish Institute, of electing me an honorary Fellow, and I hailed with satisfaction the appointment of a very intimate friend, Lord Fitzgerald, as its President. He, like myself, was not brought up to the profession with which he has thus been associated; but, with the talent which he possesses, I have no doubt that his friends and colleagues will derive much advantage from his connection with their Society.

I look upon this, and our sister Institute in Ireland as one; though separated by St. George's Channel, we have but one and the same object in view, and are pursuing the same road for its attainment. In my double capacity therefore of member of both Institutes, I beg leave again to repeat the pleasure I experience in seeing you, Sir, (to whose exertions I believe I may say our sister Society, is very mainly indebted for its present position, and whose own private and professional character is so deservedly eminent,) now present to take your seat amongst us, as one of our own members. And I feel confident that I express the unanimous sentiments of every one who hears me, in offering to you, and through you, to the Royal Irish Institute our most cordial wishes for continued prosperity.

Mr. Morrison said,—In rising to return thanks for the kind reception I have met, on the occasion of this my first visit to your Institute, and for the obliging expressions which your Lordship has addressed to me, while I feel that I am indebted for both to the position which I hold with relation to he sister Institute in Ireland, I am not less proud of the honour done me, or less grateful for the manner in which it is conferred.

It is, indeed, my Lord, to me a most gratifying circumstance to find, that the efforts I have made to establish, on a proper footing, an Institute of Architects in Ireland, are appreciated by your Lordship and by a Society such as this; and that the success which has crowned my exertions is hailed by a body of gentlemen so qualified to judge of its importance. It assures me, my Lord, not only that the unnatural state of depression, in which for so long a period the professors of our art have been placed in the sister kingdom, was deplored with the sympathy of generous feeling, by our professional brethren in this country, but that by those whose judgment on such a matter must be decisive, it was *felt*, as it is pronounced to be, *undeserved*.

I have never, my Lord, for a moment, mistaken the claims of the architects of Ireland, to hold the position and to participate in the honours which in this and in other countries, are conceded to the instructed professors of our beautiful art. In literature, in science. and in the display of poetic taste and feeling, Irish genius has not been behind that of other lands, in earning for itself "a station and a name;" and in our art, which demands the union of both taste and knowledge, its Irish professors, as far as opportunities have been afforded them, have (I trust I may say) shewn themselves not unendowed with the admitted talent of their country. I have, then, ever felt, that it has been owing to other unhappy causes, and not to want of ability amongst us, that in Ireland architectural science has been depressed, as it has been undervalued. The dark cloud which, from whatever cause, has hung over the destinies of that country, has discouraged the efforts, as it has depressed the spirits of her children; but still, amidst her darkness, beautiful structures have sprung up from time to time, to testify that architectural taste and ability were there, which under happier auspices, would shed a lustre on the land where they were protected; and record, with enduring monuments, the history of her reviving prosperity and social peace.

It was with this feeling that, while I regretted the past depression in Ireland of the art I loved, and with the cultivation of which I associated the brightest visions of my country's happiness. I felt encouraged, under the awakening aspect of Irish prosperity, in making an effort to exalt my profession in Ireland, by vindicating the true dignity of its educated members. I do not wish to dwell upon a subject which would, by implication, attach discredit to those, who from their station in society, should be the natural protectors of native talent; suffice it to say, what alas! is too well understood, the architects of Ireland have not been valued or encouraged by the wealthy and educated classes of their own countrymen; and they have now sought to win the favour, and the respect, which have been unjustly and unwisely withheld from them, by showing that they understand their own proper merits, and that they have learned to respect and to do justice to themselves.

Such, my Lord, has been the origin of the Royal Institute of Architects in Ireland, to which your noble Society has generously held out the right hand of fellowship, and of friendship; declaring that you esteem us "as a branch of your own Institute in every thing except the name."

For myself, then, and for the Members of the Irish Institute, which has been so honoured and encouraged by this approbation, allow me, my Lord, to return my sincere and grateful thanks. We feel, indeed, that in encouraging and promoting the success of the Irish branch of our profession, they have consulted our common interests, by vindicating the dignity of an art, which we, in common venerate; but while their conduct towards us, has been wise, as it has been generous, we are not from our sense of its prudence, on that account the less grateful for its manifestations.

To all and to each of the members of this Society, I return the respectful and earnest thanks of the body over which I have the honour professionally to preside. Where there are so many who have honoured us, and from whom approval and encouragement are, indeed, so flattering, it is difficult to name individuals to whom we would in particular, be desirous to render our acknowledgments. I may, however, venture to mention *one* whose approbation is no less valuable from his acknowledged attainments, than from his rank; and whose esteem is equally flattering, as, emanating from his good feeling or from his good taste. I need scarcely say, I allude to the noble President of this Institute, one of the first in this country who hailed the establishment of the Institute of Irish Architects, and of whose support and patronage, extended to a scientific association such as ours, it may truly be said, "Auctor preciosa facit."

To Earl de Grey then, the Vice Presidents, and the Members of the Royal Institute of British Architects, I return the warmest acknowledgments I can express, from myself, and from the body which I represent.

Letters were read, from Mr. C. H. Smith, accompanied by a specimen of white marble from America, imported for the first time.—From Mr. Chantrell, of Leeds, on a remarkable case of decay in oak timber, and several other communications from the members and correspondents of the Institute.

Mr. Fowler read a paper on the mode of warming and ventilating the Custom House on Dr. Arnott's principle, which elicited a well merited compliment to Dr. Arnott for the liberality with which he has placed his scientific inventions at the disposal of the public at large.

The noble President then congratulated the Society on the success which had attended the proceedings of the session. The accession of ten Fellows, nine associates, one honorary member, and two foreign members, sufficiently attested the estimation in which the Institute was held by all classes connected with architecture. With regard especially to the interest taken in the proceedings of the Institute by foreign architects, his Lordship adverted to the valuable paper on Greco-Russian ecclesiastical architecture, contributed to the literary funds of the Society by Herr Hallmann, which had been acknowledged by the presentation of a medal to that gentleman. It was further to be observed with reference to the manner in which the Institute had been supported in this respect during the session, that no lectures had been delivered in the rooms—and however desirable the delivery of lectures might be, in bringing before the members in a condensed form, much information on subjects for the study of which they could not otherwise afford time, yet it was undoubtedly to be noted as a proof of the increasing prosperity of the Institute, that the influx of communications on professional subjects had been such as to occupy the meetings during the whole session, and leave no opportunity for hearing lectures. Of the value of the papers read it was not necessary to speak, but of the advantages resulting from the mere circumstance of professional men uniting together, an instance had been afforded during the present evening, when in consequence of a conversation which had occurred at a former meeting on the subject of the remarkable arch between the Western towers of Lincoln Cathedral, one gentleman had produced a drawing of the arch, and another, a resident at Lincoln, had explained its construction; and thus, said his Lordship, information is elicited and science promoted. His Lordship then adverted to the volume which had been announced of the Transactions of the Institute. The question had sometimes been put to him, "what were the Institute doing?" The former volume of [illegible] between [illegible].

[illegible]

[illegible] their [illegible] in the highest degree.

NOTES OF THE MONTH.

Blenheim Palace is likely to be repaired at the public expense: a bill is now before Parliament for providing the necessary funds.

Blackfriars Bridge was closed on the 21st ult. against all horse-conveyances, for the purpose of completing the repairs and laying the roadway, which are expected to be finished and the bridge again opened by the 1st of next month.

At Brighton, Sir Samuel Brown is engaged in making a survey and taking soundings of the coast, for the purpose of ascertaining whether it is practicable to construct an asylum harbour by means of an extensive breakwater.

We perceive by the daily papers, that Mr. Barry has had several interviews with the Commissioners of Woods, &c. on the subject of laying the foundation-stone of the new Houses of Parliament: we were in hopes from the rapid progress that is being made in the erection, that this mummery was likely to be done away with—we hope so still: it is quite a farce, to call it the foundation-stone, now that the building has considerably advanced in height above the ground.

The houses lately built by Mr. Cubitt, in Lowndes Square, near Belgrave Square, in the combined styles of the Elizabethan and Venetian, are deserving of a survey by the [illegible].

We are happy to hear that Government has determined to have engraved, at the public expense, the elaborate drawings of St. Stephen's Chapel, which have been made with great care by Mackenzie.

The design for the Oxford memorial to the martyrs is decided in favour of Mr. Scott: we understand that it is in the style of Waltham Cross.

The Duke of Devonshire's grand picture gallery at Chatsworth, which was commenced under the superintendance of the late Sir Jeffry Wyatville, has been just completed. Many of the gems of art at Chiswick and Devonshire House it is said, will be transferred to this gallery.

The sum of £3,000, has been voted by Parliament for the improvement of Trafalgar Square. This amount appears to us very inadequate to do all the work stated in the report given in the last month's Journal. A Committee of the House of Commons has for some time been sitting, to consider whether it would not be prejudicial to the effect of Trafalgar Square and the adjoining buildings, particularly the National Gallery. The following queries have been put to Sir Richard Westmacott and Messrs. Barry, Deering, Donaldson, Burton, Sydney Smirke and others, with the view of eliciting the opinions of those artists on the subject. When the report of the evidence has been published, it will be interesting to see how these gentlemen have treated the matter, and the reasons they may adduce for their various opinions.—What effect, in your opinion, will a column, of which the pedestal, including the steps is 45 feet high, and the height altogether 170, have upon the National Gallery? What effect, in your opinion, will the said column have as an ornamental object, in combination with the surrounding buildings? What effect will the column have on the National Gallery as you approach it from Whitehall? How far do you consider that position a favourable position for the column itself? The answers, we think, cannot be doubtful. The plans, &c. can be seen by application at the Committee Clerk's office.

Mr. Bielefeld, with considerable ingenuity, has applied Papier Maché to a new purpose, that is for delineating the map of a country, by the aid of which, he is enabled to shew all the eminencies in relief, and at one view the comparative height of the mountains, and a general character of the country. The model which Mr. Bielefeld has lately completed of the Pyrenees, is now exhibiting at his manufactory: it was made from the elaborate model of Sir T. L. Mitchell, who devoted very considerable labour to it in marking out the seat of the Peninsular warfare, together with the principal rivers, mountains, vallies, villages, towns, and forests, which are all laid down to a scale with great accuracy.

At the distribution of prizes at the King's College on the 1st ult., Professor Moseley read a statement of the progress of the department of Civil Engineering and Architecture: it was replete with information, and of such a gratifying character, that we regret we cannot publish it in our present months' Journal as was our intention. The mode of instruction is very excellent, as laying the foundation of an intuitive education, and renders a youth capable of appreciating the value of the profession of which he is to become a member, as well as prepares him to apply the knowledge he has obtained to practical objects in the office of the engineer or architect.

DREDGE'S PATENT SUSPENSION BRIDGE.

Sir,—I noticed a letter in your last Journal from Mr. Curtis, on suspension bridges, and am sorry, on his account, that he should have so strangely attempted to mislead the public on so important a branch of mechanics. He has there stated that in 1838 he submitted his invention to the British Association at Newcastle; that mine was introduced to their notice last year, 1839; that there is an identity of principle in the two inventions, &c. Now unfortunately for his claim to priority, I patented my invention early in 1836, and carried it into practice successfully the same year, in the Victoria Bridge at Bath. I was at Newcastle in August, 1838, and there submitted it to the British Association, who unanimously acknowledged its merits (see the Journal, vol. i. p. 330), the particulars of which were published in No. 794 of the Mechanic's Magazine.

At Birmingham, in 1839, I read a paper on Bridge Architecture, and no one disputed the position I assumed. Mr. Curtis must be well aware of these facts, for I believe he was present at both meetings, but why he has found it convenient to forget the former, I must leave for him to explain. I am, however most astonished that he should so imprudently assert that there is an identity in our plans: it is an assertion that he cannot prove, and it is impossible for the most ordinary observer to look at them, without detecting that difference which he pretends not to see. I would here ask him, was his important discovery acknowledged by the British Association to be new and correct? and if so, has it ever been carried out in practice? I would thank him to answer these questions, and also to state the difference between the bridge of which he says he is the original inventor, and that proposed by M. Poyet, 40 years ago, and the one at King's Meadows across the Tweed, constructed in 1817.*

It now remains to be observed, that Mr. Curtis, as an inventor, has no reason to complain, as his invention is very different, is undoubtedly of later date, and is in his own opinion, the best of all suspension bridges. If you will insert in your useful Journal, the above, you will oblige, Sir, your humble servant,

JAMES DREDGE.

Bath, July 3, 1840.

---

* Drewry in his work on suspension bridges, has given particulars and drawings of these bridges.

STEAM PASSAGE TO INDIA.

The Prospectus of the proposed Company for carrying into effect the long dormant plan of traversing, by means of steam, the distance between this country and our Oriental possessions, has been extensively circulated during the present month; and from the vast importance of the subject which it embraces, as well as from its intrinsic merit, and the solidity of the basis upon which the scheme therein set forth stands, it merits a more elaborate notice than we have hitherto been able to give it.

Since the year 1834, two Select Committees of the House of Commons, and one Private Committee, composed of men of the highest character for honour, intelligence, and wealth in the city of London, have sat at intervals of from two to four years, and have thoroughly sifted the question of Steam Communication to India. The labours of these three committees are embodied in as many volumes of evidence, published respectively in 1834, 1837, and 1839; and it is upon the unanimous, and almost undivided opinions and judgment of such men as the Honourable Mountstuart Elphinstone, Lord W. Bentinck, Sir Pulteney Malcolm, Captain Sir David Dunn, Messrs. Maudslay and Field, and other eminent engineers, and a host of other authorities, equally valuable and weighty in their respective departments, that the present undertaking has been determined upon.

The line of route adopted by the Company, is the one so ably and so successfully advocated by Captain Barber in his pamphlet on the subject, namely, by sea from the English port of embarkation to Alexandria, thence over the Isthmus to Suez, and thence again down the Red Sea to Galle, and along the Coromandel coast to Madras and Calcutta. The other routes, as is well known, are the Cape line, the Syrian and Euphrates line, and variation of the Alexandrian line, by crossing the territory of France from Dieppe or Calais to Marseilles; but the objections to all these lines are so incontestibly strong, when compared with the simple and continuous route determined upon by the Company, that it needs only to place a few of the leading points before our readers to induce them to coincide in the decided opinion which we have formed as to the respective merits of the different lines. A glance at the table of relative distances, set forth in the Map appended to Mr. Curtis's temperate and manly exposure of "The state of the question of Indian Steam Communication," will show that the number of miles between Calcutta and England by the Cape route is 11,750, being 3,430 miles greater than that by Suez and the Red Sea, consequently lengthening the voyage, and materially enhancing its risks and annoyances, not to say its expenses, beyond those which will attend the line chosen. It must however be fairly stated, that even the Cape line, with all its inconveniences and additional delays, would be far preferable to the chimerical and impracticable scheme for converting the Euphrates and Tigris into English canals, and for taming the wild Nomadians of the Syrian and Mesopotamian deserts down into well-behaved honest rovers. Nay, we find amongst the minutes of evidence taken before the Private Committee, of which Mr. Curtis was the chairman, that Captain Barber, who is incomparably the best-informed, and the most sagacious and far-seeing of the Steam Company's agents, has expressly taken into his calculation the possibilities of a future war with some of the Continental Powers, or a change in the Egyptian Dynasty, shutting up the Suez line of route, in which case the Cape line would be adopted as a *pis aller;* and Captain Barber, very wisely in our opinion, grounds his reasons for advocating the adoption of the largest class of vessels (2000 tons and 600-horse power) upon the distant contingency of such a war arising, and compelling the Company to send their boats round the African Promontory, in which case the size and consequent speed of the vessels would add to their security, and diminish the duration of the voyage.

Few of our readers would credit the statement, if unfortunately too flagrant proofs could not be adduced of its exactitude, that the state of the communications by sea, between the three Presidencies of Bombay, Madras, and Calcutta are at this moment very little better than they were in the days of Clive or Macartney: there are certain periods of the year during which the Monsoon rages alternately on the Malabar and Coromandel coasts, and during the continuance of these winds, which may truly be styled the *approbrium mercatorum*, the intercourse by sea between the different civil and military stations is almost closed. The steamers plying between the Presidencies, including those established on the line from Bombay to Suez, are totally unequal to the effort of contending with the south-west Monsoon; consequently, the ports are, so to speak, shut up, and the communications take place by the tedious and precarious foot-post or dâk, which runs between Madras and Bombay, and Calcutta and Bombay and Madras, and which is shown by the evidence of Mr. Elliott and others, before the Select Committee of 1837, to be wholly inadequate to the effort of carrying communication as rapidly as might be done between the three Governments, in cases of emergency which are liable to arise from day to day. We have asserted that the steamers now employed by the East Indian Government as mail-boats between Bombay and Suez, are not equal to the effort of facing and mastering the Monsoon during the four months of its duration, from May to September. This assertion is borne out by the fact, that the Atalanta was compelled to put back to Bombay in April 1839, and the Berenice broke her beam in an unsuccessful struggle to make the passage against the Monsoon; and the powers of these two vessels afford a very fair criterion of the capabilities of the remainder, which the East India Company has declared it to be its determination not to alter or increase. Under these circumstances it becomes a matter of vital importance to Madras and Calcutta, but more especially to the latter city, which is the emporium of the East, to set on foot such a means of constant and continuous communication as will supply the glaring deficiencies of the Company's establishment; and after the most mature deliberation, aided by the experience and inventive capacities of some of the most eminent men in the respective departments of the Royal and the Commercial Navy, Civil Engineering, and other Scientific Professionist, to whose testimony is added the unerring and triumphant evidence afforded by the successful experiment tried by the Atlantic Steam Company, as to the capability of steam to overcome the obstacles of wind and weather, the Indian Steam Directors have determined upon building vessels of a tonnage equal to the mastery of the Monsoon gales, consisting of boats of two thousand tons and of six hundred horse power. Of these boats there are to be seven, namely, four in the Indian seas, and three on the European side, which number will, it is confidently anticipated, be fully equal to maintain the monthly communication with the three Presidencies, which it is the object of the patriotic and public spirited gentlemen forming the present nucleus of the Company to achieve, and whose efforts deserve the grateful co-operation of every right-thinking man in the British empire.

There is one topic which we have yet to touch upon as connected with the subject before us, and that is the question raised by the East India Company, as to the expediency of confiding the transport of the Indian mails to a Private Company. * * Appended to Mr. Curtis's pamphlet on the State of the Steam Question is a pertinent document, furnished by the East India Company itself, which ought to convince every holder of India Bonds, that the sooner the conveyance of the mails is made over to a competent, well-arranged Company, the better is his chance of continuing to secure his present ample dividend. The document referred to is entituled, "A Return of the present Annual Cost to the East India Company of *maintaining* (?) the communication between Bombay and Suez." This return extends only to the period of eight and a half months; but an approximate calculation has been formed on its figures, extending it to an entire year, from which it is shown that the total expense of maintaining the four steamers now employed (including an allowance of fifteen per cent. on the prime cost of the vessels, £162,000, for wear and tear,) amounts to £182,828. The receipts, according to the same approximate estimate, were, for passengers £9,534, and the British Government allowed the sum of £50,000 for the transport of the mails: thus a dead loss of £123,294 has been incurred in one year on the present incomplete and inadequate establishment, which cannot perform what it purports to do during four months out of the twelve; and if the number of boats were to be increased, and the establishment extended, the loss would be proportionably greater. The only means of diminishing this loss, or of turning the scale the other way, is by the *conveyance of passengers.*

Having thus, at a considerable, but we trust not an useless, expense of time and labour, endeavoured to demonstrate the physical and commercial advantages of the proposed plan for reducing the distance between Great Britain and her Indian territory, let us turn for a moment to the consideration of the incalculable, the inestimable blessings which must inevitably follow in the immediate train of such increased facilities for intercourse. We have laid it down above, as an axiom, that civilization and benefits of all classes flow naturally from the establishment of a continuous stream of transit; and if this be true with respect to the deserts of Arabia, how much more applicable is it to the fat and fertile plains of Bengal, and of the Payen Ghauts, and the millions who cultivate them? To the philosopher, the poet, the philanthropist, the Christian, the mighty results which may be anticipated from rendering the access to the shores of India safe and easy, are at once exhilirating and overpowering; nor is the gradual and insensible amelioration which must of necessity take place in the minds and religious feelings of the peaceful and tractable Hindoos, by the mere progress of events, independently of the efforts of the Christian missionaries and others, amongst the least of the blessings which British domination and British communication will bestow upon the natives of India. What a field will there not be opened up for encouraging and creating fresh agricultural enterprizes! what schemes for reconstructing the gigantic machinery which formerly existed in the Carnatic and Mysore countries, for the irrigation of the thirsty, though productive soil, may not be expected to be formed, as soon as the capabilities of the country are developed by the discerning eye of the practical engineer! Who can estimate the increased consumption which will ensue of British manufactures, as soon as the natives discover that they can employ themselves more profitably in raising agricultural produce for barter or sale, than in wielding the shuttle and beam? If even manufactured cottons to the amount of two fanams a head, (1*s.* 3*d.*) were to be taken by the populations of the Carnatic, Canara, Bengal, and Orissa, the annual increase in the export value of calicoes would be more than £3,000,000, and surely this is a consideration worth the attention of our manufacturing classes.—*Abridged from a Morning Paper.*

STEAM NAVIGATION.

Steam Tug.—On the 9th July, 1840, a trial satisfactory in its results was made of the new steam tug boat, which has been built for the River Clyde Trustees, by Messrs. Hedderwick & Rankin. The engines by Messrs. Smith & Rodgers, under the personal superintendence and specifications of William Buld, engineer of the Clyde. This small steamer has been built for the purpose of drawing the punts which carry the material dredged up in deepening the river. She is about 140 tons. Her dimensions are, keel 82 feet long, with fore rake 86 feet; breadth between paddles 18 feet, depth 9 feet, and draws 5 feet 8 inches of water. She carries two engines, each about 30 horses power. Diameter of cylinder 30 inches; length of stroke 3 feet 6 inches. The diameter of the paddle-wheels are 12 feet, and float-boards 5 feet 8 inches by 1 foot 2 inches. If the engines make 34 strokes in a minute, the velocity of the wheel per hour will be 4·58 miles. This little steamer has been constructed in the most solid and substantial manner, only for the purpose of drawing heavy loaded punts, and not for speed; yet upon her first trial, and against a strong breeze of wind, she steamed from Glasgow to Port Glasgow, a distance of eighteen miles, in one hour and fifty-nine minutes; and there can be no doubt that her speed will exceed ten miles an hour when everything shall have been put into proper working order, for she has run from Glasgow to Renfrew, a distance of five miles in 32 minutes.

Pacific Steam Navigation Company.—On Tuesday, the 4th ultimo, the Peru, one of the vessels belonging to the Pacific Steam Navigation Company, started from her moorings at Blackwall on an experimental trip down the river and back to Blackwall. She is a very splendid steamer; her engines are of 90 horse power each, and her burden 700 tons. Over her paddles are placed safety boats of a large size, and capable of affording means of escape for the crew and passengers, in the event of fire or any other accident to which long voyages are exposed, but which precaution, there is every reason to think, from the excellent arrangements of this steamer, will be superfluous. Nevertheless, it is a matter of congratulation to those who are about to traverse the immense space of water which divides England from South America, that such contrivances have been adopted for their security, and great praise is due to Captain G. Smith, the inventor and adapter of these safety boats. Their appearance adds to the elegance of the steamer, they take up less room than the paddle-boxes which in general cover the paddles, and, as they are more snug, so they hold less wind, and consequently occasion less impediment to the speed and management of the vessel. This adaptation has been made use of in the royal navy, and has been found to answer all the purposes intended by the inventor, but it has never been employed in mercantile steamers until on board the Chili (which belongs to this company) and the Peru. A model of the invention has been exhibited at the Polytechnic Institution, and the results exhibited in miniature have been satisfactory. The Peru and the Chili were both built in the yards of Messrs. Curling and Young; their engines are from the manufactory of Messrs. Miller and Ravenhill. In these vessels coal will not be used during the voyages, but the prepared fuel of Mr. Oran will be substituted. The Chili started about a fortnight previously. Both she and the Peru will touch at Rio, and proceed through the Straits of Magellan to the Pacific Ocean. The arrival of these vessels in the Pacific will be an era in the history of navigation. They will create a communication between localities which cannot be attained by sailing vessels under two months in the short space of a fortnight, and will help in no little degree to civilize the inhabitants and restore good good government,—a desideratum too long wanted in the regions to which their operations are destined. It

[illegible]

PUBLIC BUILDINGS AND IMPROVEMENTS.

[illegible]

[illegible] was the [illegible] Mr. [illegible] Sutler, of Aber[illegible]

[illegible] by the list of advertise[illegible] to be contracted for and [illegible] the directors of Mr. Rhodes [illegible]

PROGRESS OF RAILWAYS.

RAILWAYS IN BELGIUM.

A Report [illegible] Chambers of Belgium, con[illegible] public works. It appears that the [illegible] railways was enacted on the [illegible] May 1834 [illegible] Government was authorized to con[illegible] starting from a common centre [illegible] Mechlin [illegible] network for connecting different parts of the country. [illegible] lines were thus designed—the eastern [illegible] the Prussian frontier, by Louvain, Liege, and Verviers, [illegible] metres: the northern line, to Antwerp, with a [illegible] of 25.500; the western line, upon Ostend by [illegible] Bruges [illegible] 127.111: the southern line to the frontiers of France, [illegible] and Mons, of 108.132. By the law of the 26th of May, 1837, [illegible] were added, viz. one from Ghent to the French frontier and [illegible] Courtray, 75.160 metres: the line of Namur, 66.074; the [illegible]; making in the whole, 131.976 metres additional. [illegible] 449.082 metres of railway. The proportion actually [illegible] metres: that in course of execution 43.453; [illegible] execution, 186.338 metres. Upon the 309.291 metres of [illegible] are established with a single line of rails or [illegible] 82.909 metres, on two lines, comprehending the [illegible] Brussels to Antwerp, from Mechlin to Ghent, and from Mechlin [illegible] incurred to the 30th of September last for the lines [illegible] course of construction, the railroad, buildings, and [illegible] 55,264.211f., or about 2.200.000*l.* On the [illegible] last law for the construction of additional lines, the expe[illegible] out the first lines enabled the Government to [illegible] estimate of the presumed cost. The differences betwixt [illegible] first lines and the actual expenditure, however inte[illegible] will not surprise those in this country conversant [illegible] details of railway enterprise: thus,—

	Estimate. Francs.		Cost. Francs.
[illegible] &c.	16.512.000	,,	24.177.648
[illegible]	741.100	,,	2.100.549
[illegible]	3.074.000	..	7.321.852
[illegible] &c.	2.000.000	..	8.300.1[illegible]
[illegible]	502.230	,,	1.394.475
[illegible]	22.839.330	,,	43.294.659

[illegible] the total amount of estimates. It is [illegible] first works of the railways; 138 per [illegible] 182 per cent. upon the stations, [illegible] the material of transport, &c. Con[illegible] possessed by Belgium for the formation of [illegible] ground, in the abundance [illegible] comparative price and plenty [illegible] estimates and the ascer[illegible] considerable not to appear ex[illegible] advantage of being all combined [illegible] centre, and of being [illegible] must have tended greatly to [illegible]. But it must not be forgotten [illegible] to guide, all previous [illegible] in the end. The pro[illegible] presents these results:—On [illegible] was 3: of carriages, [illegible] May, 1836, the num[illegible]. On January 1, [illegible] 47. On January 1, [illegible]. On January 1, 1839, [illegible] the 1st of November, [illegible] for passengers, 392: of [illegible] to show to what a [illegible] made available for merchandise. The [illegible] made up, so that the [illegible] as they are of [illegible] the expense [illegible] more than [illegible] per cent. The increased [illegible] increased pressure of [illegible] passengers and merchandise. The progressive aug[illegible] stated.—For the eight months of 1835, the [illegible] opened, 421.439 passengers; 1836, two sections, [illegible] 1837, three sections during eight months, and six during 4 months), [illegible] 1838, six sections during three months, eight for four months, [illegible] months, 2.238.[illegible]03; ten months of 1839, ten sections for nine [illegible] and 13 for one month, 1,694.019. Thus in the space of something [illegible] years 5.609 645 persons have paid as passengers on the Bel[illegible] roads. The fares in the first instance were fixed too low, and of [illegible] no fair return for capital sunk. Last year the rates were ad[illegible] from the mean price of 1f. 43c. per head in 1838 to 2f [illegible], and the [illegible] product of the passenger traffic, which for the month of September, 1838, was 312.542f. ascended in the same month of 1839 to 461.339f. The [illegible] receipts from 1835 to the first nine months of 1839 inclusive, amount to [illegible]; the expenses to 6,422.071f.; nett product, 2 337.[illegible]. It may be remarked, that the single line of Brussels to Antwerp, which alone was open in 1835, yielded a larger net return than the clear produce of the whole of 1838, when ten sections were opened. The nett result, after payment of all charges, of the first was 403,997f.; of the second only 364.665f.; from which it may be inferred, as indeed is the fact, that several Belgian lines do not defray the charges of working, and were probably only decided upon in deference to local interests, which could not conveniently, and for political reasons, be denied. The carriage of merchandise commenced only with 1838, the product of which year was 58.591f., and in ten months of 1839, 351.747f. The regular progress during the last year month by month was remarkable, the amount of receipts for January under this head being 7.713[illegible] and for October, 74.790f. The Belgian Minister declared that a stock of 400 waggons for the transport of merchandise was far from being adequate to the wants of trade. In the first instance the directors of railroads commenced with letting out empty waggons to the common carriers, and confining themselves to the mere service of forwarding them with the trains. But this method not proving satisfactory to all interested, a charge is now made according to tonnage, that is, one rate of price for all under 1.000 kilogrammes, and another for all above. The tariff for the first is 40 cents. per ton, or 4 cents. per kilometre, or per 100 kilogrammes; for the second, or all above 1,000 kilogrammes, the invariable charge for all kinds, whether by measure or weight, is 13½ cents. per ton. There is a difference, however, in regard of the location of the waggons, which may be supposed to be optional with the carriers, and is charged in that case 18 cents. per ton. These rates are provisional only, and are so headed in the list of charges, as "provisional tariffs for the carriage of merchandise." It is hoped that by improvements, savings in expense, and the increase of traffic, these rates may yet come to be reduced.

It is singular that in the face of this extraordinary increase of railway traffic, the travelling and carriage on common roads in Belgium should not only not have diminished, but progressively been on the increase. The contrary was universally anticipated there, as here, where in many localities such a result has been verified. The following statement of the produce of the *peage des barrieres*, answering to our turnpike tolls, will show how the case has worked in Belgium:—The produce of the *peage* tolls let to the highest tender in 1831 was 2,390,882 francs; in 1832, 2,195,343f.; in 1833, 2,360,461f.; in 1834, 2,415,769f.; in 1835, 2,385,430f.; in 1836, 2,447,985f.; in 1837, 2,584,791f.; in 1838, 2,759,548f.; in 1839, 2,749,301f.

M. Nothomb, the Belgian Minister, gives as the result of his calculations the following comparative analysis of the advantages resulting to the public in time and money between the ancient mode of travelling by diligence and the railroad system, at the least increase of rates by the tariff of 1839. The mean result is stated to amount to a "saving of one half in time, and of 33 per cent. upon fares." The saving in price is thus subdivided; by diligence or first class carriages, 15 per cent.; by open carriages, 30 per cent.; by waggons, 60 per cent. The more humble orders of society profit, therefore, most largely, as ought to be the case everywhere, by the establishment of railroads. In Belgium, where the railroads were undertaken directly by the state, a consummation so desirable was, of course, more easy to carry into effect at any time. But the fact may suffice to show, that here it should have been the business of the legislature to introduce stipulations into all railway bills which would have secured the same proportionate advantages in favour of the lower classes.—*Times*, July 6.

Edinburgh and Glasgow Railway.—The following particulars respecting this important undertaking are abridged from the ***Glasgow Constitutional*** of Saturday, the 4th ult.—The works on the line from Edinburgh to the Almond Valley, a distance of about eight miles, have recently been commenced, but they are neither of a difficult nor of an expensive character. The line will be carried across the valley by means of a viaduct of 36 arches, of 50 feet span, and vary from 60 to 85 feet high. Near this point it has been found, on levelling some of the embankments formed last year, that the subsidence was only three inches, although the earth had been raised so as to allow 21 inches to subside. This arises from the mixed character of the materials used (stones, blaze, &c.,) and will prove a great saving in the future maintenance of the line. Onwards to the west, the line passes through the Winchburgh Whinstone Ridge, and here is a tunnel of 360 yards, of which 250 yards are completed. This important work is proceeding rapidly. The Avon and the valley through which it runs are crossed by a stone viaduct of 20 arches, some of them upwards of 90 feet high. This will be a beautiful piece of masonry, and will give increased effect to the picturesque views of the Avon valley. The approach to Falkirk presents many fine views of the Carse and the Frith of Forth. The high ground immediately behind Falkirk is crossed by a tunnel of 880 yards, of which 270 are completed, and the drift mines greatly advanced. The view, on emerging from the west end of the tunnel, bursts on the eye, with the panoramic effect of a splendid landscape—the foreground—the rich valley of the Forth, with Stirling Castle in the centre—Benledi and the Ochil Hills, marking out the margin of the plain, and Benlomond and the Grampians filling up the picture in the distance—the whole forming an assemblage of objects of surpassing natural beauty. The line, after crossing the Union Canal which it does on a magnificent arch of 130 feet span, continues nearly level for some miles, is of easy execution, and is partly finished, and possesses no feature of engineering interest, until it reaches the neighbourhood of Castlecary, where it crosses the Cumbernauld road, and a deep ravine, by a viaduct of eight arches, nearly 100 feet high—the one end terminating on an embankment, and the other resting on the remains of a Roman camp. Here will be the station for Stirling and towns to the north of the Forth. The line beyond Castlecary commands an extensive view of the valley. Croymill is the summit of the line, and here there is an excavation of a ridge of whinstone and freestone of considerable depth, presenting no difficulty, however, but what time may overcome. At Cowlairs, near Glasgow, will be erected the engine establishment; and here the fixed engines will be placed to work the tunnel to Queen Street. The incline will be about 2,000 yards, consisting of open cut and a tunnel, divided by eyes into three portions of 550, 300, and 298 yards. From the head of this incline to Edinburgh, the ruling gradient is 1 in 880; presenting, in the facility and cheapness of working it, almost all the advantages of a level line, of which two-thirds are nearly level. The distance being 46 miles, the mail trains will easily run it in one hour and a half. Upwards of 400 yards of the tunnel are completed, and upwards of 200 yards of Guide Mine is carried forward. The contract are all let to be completed by the 1st of August, 1841, and the engineer is directing his energies to realise the opening of this great national undertaking by that time. Much work is done, and this has been greatly advanced by the late fine weather, but a great deal is still to do. There are employed on the line, however, upwards of 8,000 men, horses to correspond, and ten or twelve fixed engines; and, if the weather prove auspicious, this force is adequate to the work.

Hull and Selby Railway.—The importance of this railway, of the opening of which more detailed notice will be found in another part of the Journal, justifies a few remarks of our own. It is comparatively but little known in London or in the share market, partly from the shares being held chiefly by parties in and near Hull, and partly from one of the termini, Selby, being a small town upon the banks of the Humber, or more correctly the Ouse, and many thinking that this is a branch from a main line terminating at Selby. To correct this impression, the name "of Hull and Leeds Junction," has lately been added in the Director's reports, which gives a better idea of the object of the line, although it is less correct, as the Leeds and Selby connects the Hull and Selby line with Leeds, Selby being an intermediate station. The Hull and Selby may, indeed, with equal truth be called the Hull and York, or the Hull and Liverpool, or even the Hull and London, as the Hull and Leeds, because, with the intervention of other railways, it connects Hull with the metropolis and the other places we have named. In this remark on the name we by no means intend to undervalue the importance of this railway, and the very properties we have named of so many lines being connected into one or diverging from it, is proof of our opinion that it ought to be and will be better known to the public than it hitherto has been. In the more extended sense, it forms the eastern link of the chain of railways which, when the Manchester and Leeds is opened, will join the Irish Sea, and the Atlantic with the German Ocean and the North of Europe. With the exception of the bridge over the Ouse, constructed so as to allow ships to pass through, some other bridges, and a long embankment upon the Humber, there has been but little of expensive engineering works to contend with. This railway is 31 miles long, is practically straight and level, excepting the short lengths at the bridges, and to these unusual facilities are, we suppose, in a great measure, to be ascribed the rather unusual facts, that both the ways of this line have been completed without a second application to Parliament for additional power to borrow money, or otherwise, and that the Directors have been enabled to complete both the ways before they opened any part to the public.

The American Engines on the Birmingham and Gloucester Railway.—(COPY.) To W. GWYNN, Esq.—Sir,—In reply to your request, I now briefly give you the results of our trials with the *Philadelphia* engine (manufactured by Mr. Norris, of Philadelphia, U. S.,) and the following are the facts up to the present time. 76 chains in the incline of 1 in 37½ have been made ready with a single way, and 3 chains nearly level have been laid temporarily to rest upon before starting. The road is quite new, and consequently not firm nor well gauged, and the works going on close at hand occasionally cover the rails with dirt. The waggons used are of a large class, like those on the Manchester and Leeds Line, and weigh, when empty, rather more than 2¼ tons, but having been sent fresh from the shops a few days ago, they work very stiffly. They are loaded with 4 tons, and generally weigh, including persons upon them, about 6¾ tons. The *Philadelphia* weighs (as she works) 12 tons 3 cwt., and her tender weighs nearly 7 tons, being in all 19 tons. She has 12½ inch cylinders, 20 inch stroke, 4 feet wheel, not coupled. The weight on her driving wheels is 6¼ tons, (as I weighed her at Liverpool,) without water. The usual loads she takes in the present state of the plane are—eight waggons, engine, and tender, with persons equal to 74 tons, gross weight, in ten minutes, or nearly 6 miles per hour; the last quarter of a mile being at the rate of 9¾ miles per hour. Seven waggons, &c., equal to 67½ tons, gross weight, in about 9 minutes, or 6½ miles per hour mean speed. Six waggons, &c., equal to 61 tons, gross weight, in sometimes 5¼ and sometimes 6½ minutes, say in 6 minutes average, or 9 miles per hour mean speed; the last quarter of a mile usually giving a speed of nearly 11 miles per hour. Five waggons, equal to about 53 tons gross, are usually taken at a speed of 13 miles per hour for the last half mile up. The foregoing results have generally occurred during fine weather, but sometimes the rails have been partially wet, and this has occasioned a difference of speed in the ascent of from half a minute to a minute and a half. The worst day we have had was the 19th instant, when drizzling showers, and the men walking over the rails with marl on their boots, rendered the way very greasy and slippery. On this day, also, the lower part of the plane had been formed only a few hours, and was very soft and badly gauged. Under these circumstances, the *Philadelphia* took five waggons and self and tender, being a gross weight, including persons, of about 53 tons, up at a mean rate of rather more than 5 miles per hour, and the last quarter of a mile was passed at the rate of 8 miles per hour. We then took two waggons off, and the *Philadelphia* took the remaining three waggons, self and tender, being a gross weight, including persons, of 40 tons, up at a mean rate of 12 miles nearly per hour, her maximum speed being nearly 16 miles per hour. I am now making trials to determine the actual pull required by these new and large waggons, and I must beg you to excuse the rough form of this paper, as I am much pressed for time.

Believe me faithfully yours,

Worcester, June 22, 1840. W. S. MOORSOM.

P.S.—I ought to add that the pressure of steam in the boiler has been from 55 to 62 per square inch.—W. S. M.

Opening of the North Midland Railway.—The North Midland Railway, which was opened on Tuesday, 30th June, not only completes the communication between this county and London, but also for several miles forms the line by which the Manchester and Leeds, and the York and North Midland Railways enter Leeds. When the Great North of England Railway shall be opened from York to Darlington, (which it will be in October,) and the Manchester and Leeds shall be opened throughout, (as it will be in December,) Leeds will, as it were, stretch out its arms to the German Ocean on one side, and the Irish Sea on the other—to the seat of government and the great emporium of the world southwards, and the county of Durham northwards. Of late years Yorkshire has been considerably behind Lancashire in commercial activity and general enterprise, in the accumulation of wealth and the progress of improvement. But is not this in part to be ascribed to the earlier connexion of the towns of Lancashire among themselves and with London by railways? We think it is; and when Yorkshire has the advantage of the same means of rapid, cheap, safe, and agreeable transit that Lancashire has had, we anticipate that her great manufacturing and commercial resources will be brought out in fuller development, and that she will advance in the race of improvement at the same or nearly the same speed as the sister county. Yorkshire is the seat of several of our most important manufactures—the woollen, the worsted, the linen, and the cutlery, besides extensive manufactures of iron, leather, pottery, &c.; and it has also the great seaport for our trade with the north of Europe, Hull, and the first corn market in the north of England, Wakefield. By the railways now completed, the manufacturing population will have their granary, Lincolnshire, and their sheep farm, Leicestershire, almost at their doors. All raw materials for manufactures will be more accessible; and all the goods manufactured will be nearer to their home or foreign markets. For health or recreation, its inhabitants will be able in two or three hours to reach either the shores of the sea or the romantic valleys of Derbyshire, or many of the most interesting objects and places of resort in our own county. The agriculturists will also be able to procure more easily those necessary articles, manure, lime, building materials, and implements, and to bring their produce more cheaply and expeditiously to market. And all of every class whom business or taste call to the metropolis will be able, in the short space of ten hours, and ere long perhaps in eight hours, to glide from the heart of Yorkshire to the banks of the "royal-towered Thames."—*Leeds Mercury.*

Opening of the York and North Midland Railway.—This line, the length of which, from York to its junction with the North Midland Railway near Altofts, is 23½ miles, (exclusive of the short branches to Methley, and of two branches to bring it upon the level of the Leeds and Selby Railway,) has been opened in distinct portions at three several times. The portion from York to the Leeds and Selby Railway, near South Milford, being a distance of 13½ miles, was opened on the 29th of May, 1839. A second portion, of about three miles in length, from Milford to Burton Salmon, was opened on the 11th of May, in the present year. And the third portion, about seven miles in length, completing the connexion between York and the North Midland Railway, near Altofts, was opened on Tuesday, June 30, when a party of directors and friends came from York, and joined the immense train from Leeds, by which the North Midland was formally opened. The York and North Midland Railway, together with the Leeds and Selby, and Hull and Selby Railways, completes the communication between York and Hull; and with the North Midland Railway, completes the communication from York to Leeds, Sheffield, and London. The York and North Midland Railway has the advantage of running on almost a dead level through its entire length, with no heavy works, except a tunnel of two hundred yards long at Fairburn, and two fine bridges over the rivers Aire and Calder. One of these bridges was erected with unprecedented despatch, only six weeks having elapsed between laying the foundation of the last pier and completing the bridge. The line has been as economical in the construction as almost any railway in the country, and promises to be productive to the shareholders. It gives great advantages to the city of York, which is thus made very easy of access to all the populous parts of the county, and is placed on the line of railway from the English to the Scotch metropolis. The engineer of this line was George Stephenson, Esq.—The York and North Midland Railway, though completed as far as regards the communication between York and London, is not quite complete as far as regards the communication by *that* line with Leeds. It joins the North Midland Railway at two points, namely, near Altofts for carriages to and from the south, and at Methley for carriages to and from Leeds: the latter branch, from one to two miles in length, is not quite finished, but will be so in a few weeks, after which passengers between Leeds and York will, we understand, be conveyed by the North Midland and York and North Midland lines.—*Leeds Mercury.*

Opening of the Hull and Selby Railway.—This railway, which is 30¾ miles in length, was formally opened by the directors and their friends, on Wednesday, July 1, preparatory to its being opened to the public on the following day. It had been previously arranged that the opening should be signalised by a grand procession. Lord Wenlock (as lord lieutenant of the East Riding), Lord Wharncliffe, the chairman of the board of directors of the Manchester and Sheffield Railway, Sir Thomas Clifford Constable, high sheriff of the county, the members of the borough of Hull, and of other places; the Mayor, Recorder, and Sheriff of Hull; the Mayor of Beverley, the Chairman of the Hull Dock Company, Chamber of Commerce, Trinity House, and other corporations and institutions, were to go in procession through the town to the railway station. But all these intentions were abandoned in consequence of the heavy rain that fell during the morning; and the directors, shareholders, and their friends, instead of starting at ten o'clock, remained at the station till noon. Indeed, it was twenty minutes past twelve when they started, in five trains, (comprising 40 carriages and about 1,000 passengers,) the first of which reached Selby at a quarter past two. The Hull and Selby and Leeds and Selby lines run into each other at the crossing of the road from Selby to Bawtry; and we understand that passengers from Hull, for Leeds or York, go through in the same carriages. The numerous party remained there, inspecting the terminus, the station, &c., till half-past four, when they started on the return trip. They reached Hessle Cliff, about five miles from the Hull station, at half-past five, at the rate of twenty-five miles an hour; but between Hessle and Hull a slight hitch occurred to the engine of the first train, which delayed it and those in the rear for a short time. However, the whole distance was performed in less than an hour and three-quarters. Great crowds were collected at Hull, Selby, and other populous places on the line. All went off well; the railway police exerted themselves to keep order; and not one accident, causing the slightest personal injury, occurred during the whole day. The directors and their friends dined together on their return to Hull in the evening. The effect of this opening is beneficial on the shares, which, it is said, have consequently risen to par.—*Leeds Intelligencer.*

Eastern Counties Railway—opening from Shoreditch to Brentwood.—About twelve o'clock on Wednesday, July 1st, the Directors, accompanied by the engineer, manager, secretary, &c., left the station at Shoreditch, and proceeded down the line to Brentwood, preparatory to the opening to the public in the afternoon; the journey, including stoppages, was performed in 45 minutes, and on their return in 35 minutes. At two o'clock the line was opened to the public, and a train, heavily laden with passengers desirous of availing themselves of the earliest moment to make the trip, left the station at that hour; and other trains, which left in the course of the afternoon, were all full. The extended opening created a great sensation in the neighbourhood of Shoreditch, Bethnal Green, &c., and it is estimated that upwards of 30,000 persons were collected on the occasion; every window, with a view of the line, was crowded, and in some instances the roofs of the houses were removed to admit of a sight.—*Essex Standard.*

The London and Blackwall Railway.—This line was opened to the public on Monday, the 6th ult. A description of the railway was given in the Journal for June last.

The Glasgow and Paisley Joint Railway, extending to 7 miles, was opened by the Directors on Monday, the 13th ult.

The Maryport and Carlisle Railway.—The first portion of this line from Carlisle has been opened. The road is a single line of rails excepting at the ends, and the work has been throughout completed in a most substantial and satisfactory manner. There are no heavy embankments on the line, but the cuttings have been severe, and in one or two places several feet of freestone rock are gone through, which must have been both difficult and expensive. The line passes down the beautiful vale of the Ellen, and crosses the river of that name three or four times. The terminus at present is at Arkleby Coal Pit, near Oughterside, a distance of about seven miles from Maryport.

Lancaster and Preston Junction Railway.—On Saturday, 11th ult., the above railway, which joins the North Union Line at Preston, and thus forms a continuous line from London to the county town, was opened to the public for the conveyance of passengers, &c.

Preston and Wyre Railway—opening throughout.—This railway, which is about 19½ miles in length, and places the rising town and port of Fleetwood on Wyre in connexion with Preston, the manufacturing districts, and the metropolis, was finally opened on Wednesday, 15th ult., by the Directors and proprietors.

The Great Western Railway—further opening.—On Monday, 20th ult., the line of the Great Western Railway was further opened from Steventon to the Farringdon Road, a distance of sixty-three miles from London.—The Great Western Railway works at the Old Bridge, Bath, are proceeding with extraordinary vigour, and greatly excite the interest of the inhabitants and passengers. The arches for the oblique bridge are in part erected, and every day supplies fresh proofs of the exertions of the contractors and the progress of the undertaking. It is expected that the Railway will be open as far as Bridgewater early in 1841, if not during the present year, a distance of 150 miles from London, which will then be accomplished by mail trains in four hours and a half. The Railway will, it is confidently expected, be extended to Swindon, 76 miles from London, in September, and the road from Bath to Bristol (12 miles) will be perfected at the same time; the entire distance between London and Bristol, by the assistance of coaches in the intermediate road, may be then performed in six hours.—*Bristol Times.*

Manchester and Birmingham Railway.—A viaduct over the valley of the river Dane, of dimensions nearly as gigantic as the one over the valleys on each side of the river Mersey, in this town, is about to be contracted for on the line of the Manchester and Birmingham Railway, between Wimslow and Crewe. It will have 24 arches of 63 feet span each, at an elevation of about 80 feet, and will be upwards of 1,700 feet in length. There will be but little difference between the one here and that over the Dane, except that the former has 26 arches, and the latter 24, with an altitude of several feet less. We suppose the cost will be much the same; the one here being, we believe, £80,000.—*Stockport Advertiser.*

MISCELLANEA.

THE ELECTROTYPE.—This important discovery of multiplying copperplate engravings, medals, &c., by precipitating copper from its solutions through the agency of galvanism, is fast progressing in this country. Joseph Saxton and Mr. Peale of the Philadelphia Mint, and Messrs. Chilton, Mapes, and Connor of this city, have made many improvements on the English process. Dr. Chilton has caused copper to be precipitated on non-metallic bodies even, by covering the paper with nitrate of silver, and thus obtaining a copperplate engraving from a mere print on paper. The *savans* of England will see that we are not behind them in science.—*New York Morning Herald.*

ELECTROTYPE.—At a recent meeting of the Academy, M. Arago exhibited to the members an impression of a copperplate, taken by M. Jacobi, by means of a galvanic current. But in England this process is already and extensively in practical use. We have now before us a copy from E. Finden's engraving of Dr. James, Bishop of Calcutta, and a copy from an electrotype plate of the same, published by Mr. Palmer, of Newgate Street, and it appears to us impossible to distinguish the one from the other; but as both are for sale, the curious may examine and decide for themselves.—*Athenæum.*

BRASS MOULDINGS PATENTED BY CUERTON.—These mouldings are a great improvement upon those made by the ordinary method of casting in brass and then filing and polishing them with considerable labour, which, after all, are never turned out true. By the patent method the moulding is first made in wood, a thin plate of sheet brass is then drawn over the surface by machinery, which is made to fit it very accurately. The patentees are enabled to offer their mouldings at a very low figure in comparison with the former prices for brass mouldings. Patterns may be seen at Messrs. Bunnet & Corpe's, in Lombard Street.

Dampier's Patent Geometric Balance.—We much regret that want of space has hitherto prevented us giving this machine the attention it is fairly entitled to. Of the many improvements in the means of weighing none have appeared so important as the simple machine now before us, indeed, it bids fair to supersede every other method now in use. The great advantage of this machine is, that so far from requiring the usual number of weights, *one* only is wanted; and this weight, from its never requiring removal, or the slightest alteration, ensures accuracy for an almost interminable period. In appearance, it is much like the "Spring Dial," and possesses all the portability and readiness of action with that machine, at the same time being entirely free from those well-grounded objections, which have kept that instrument from being generally adopted. The *mathematical* principle on which Mr. Dampier's balance is founded, renders it equally applicable for light or heavy weights, and one purpose for which it is admirably adapted, is that of a letter balance, in which form, its elegant appearance and beautiful design, render it a necessary appendage for the library.

Blowing up of Cannon-mills Bridge.—On Friday, June 26, a vast multitude of persons assembled to witness the blowing up of these mills. About six o'clock, the trains communicating with 12 charges of gunpowder of 4 lbs. each, inserted at each base of the arch, to the depth of about four feet, were set fire to; hardly had the men time to make good their escape, before seven tremendous explosions took place, carrying away the chief of the fronts of the base of each arch. Much incidental damage was done, but still the bridge remained standing. After clearing away the foundation, however, of the bridge, at 11 o'clock it fell with a terrific crush, but with no damage to any person.—*Caledonian Mercury.*

Painting on Lime, &c.—M. Heideloff, a professor at Nuremburgh, has succeeded, after many investigations and numerous experiments, in fixing paintings unalterably, and at little cost, upon lime, gypsum, and stone. The application of this process has been successfully tried in the cathedral at Bomberg. The process is extremely simple. The size, for binding the lime, is formed only of milk, and the preservation of the painting from heat, cold, and damp, is solely attributable to the method of preparing this mixture. This invention has also the additional advantage that the paintings done in this manner may be washed with water without losing any of the freshness of their colours. It may be added also, that lime receives the colours better than fresco.—*Inventor's Advocote.* [Is there anything new in this?—Editor C. E. & A. Jour.]

Kalsomine, a new paint.—A new and inodorous sort of paint, the invention of Miss Fanny Corbeaux, has been lately introduced to public notice. The materials of which it is composed, are at first soluble in water; and while in this state admit of the design being effaced, or a portion of the colouring of a wall or ceiling being removed, if necessary; a subsequent operation renders the paint insoluble, by a chemical change of the properties of the material, which fixes the colour durably. It is free from any offensive smell, dries in a few hours, is not acted upon injuriously by atmospheric influences, and is said to be more durable than oil paint, as well as more agreeable to the eye, and not at all predudicial to the health; indeed, a room painted with it one day, may be inhabited the next. It may also be made applicable to easel painting also. We have seen a little landscape painted with this material, which combined something of the depth and solidity of oil with the transparency of water-colour; and a specimen of broad flower painting, for a room, was shewn us, which had resisted the rude action of the scrubbing-brush. The effect of the white as a ground for gilding, is extremely clear without being dazzling; and we can well understand that it possesses the property ascribed to it of "softening and diffusing light."—*Athenæum.*

Novel Wind Engine.—We have been much gratified this week, in examining a wind engine for fen drainage, upon a very improved construction. The object of the inventor (Thomas Brighty, Esq., of Ramsey), seems to have been to produce a machine that shall not be affected by the head thrown against it, to render the least motion of the air available to raise a corresponding weight of water, which may be increased exactly in proportion to the strength of the wind, and (what is intirely a new feature in the above machine) it may safely be left "to take care of itself," requiring only occasional attendance; it clothes itself when the water is high, and when low, unclothes and stops; and let the wind be never so strong, it cannot stir until the water has again risen to a certain pitch; then, if the wind is sufficiently strong, it clothes and sets itself in motion, and continues going until the water is reduced to a certain level, when it at once unclothes and stops. The machinery is extremely simple, and not subject soon to get out of repair.—*Cambridge Independent.*

Soundings at Sea.—At a meeting of the Royal Geographical Society, a letter was read from Captain James Ross, of her Majesty's ship Œdipus, giving an account of some extraordinary deep soundings taken by him at sea. One of these, 900 miles west of the Island of St. Helena, extended to the depth of 5,000 fathoms, the weight employed amounting to 450 lb. Another made in the latitude of 33 deg. S., and longitude 9 deg. W., about 300 miles from the Cape of Good Hope, occupied 49½ minutes, in which time 2,266 fathoms were sounded. These facts were thought clearly to disprove the common opinions, that soundings could not be obtained at very great depths.

Inland Navigation.—A project is on foot for improving the navigation of the river Nen, from the sea to Peterborough, so as to render that place an inland seaport, connecting itself with the towns of Northampton, Leicester, Market Harborough, Stamford, &c.; and, at the same time, to drain 50,000 acres of fens, to lay dry Whittlesea Mere, and to carry lines of road through the drained country, so as to diminish the distance between London and Hull, ten miles and upwards.—*Gloucestershire Chronicle.*

A new manufacture of Tissue.—We have had an opportunity of inspecting the process for manufacturing an entirely new species of tissue and tapestry, which was originally invented or discovered by M. E. Parry, and which, we understand, has been secured by patent, and which, as the material is produced in our own colonies, promises to become an article of great commercial value. In particular, we would refer to some coverings of chairs and tapestry, which have been especially ordered by her Majesty for the palace. It bears so strong a resemblance to silk of the best kind, that it is difficult, without a minute examination, to discover the difference. The material of which it is composed, is the fibre of the banana, aloe, and other trees and plants which are plentifully found in our West India islands, and by very accurate experiments, made by order of the French Government, they have been found on an average to exceed the strength of hemp by one-fourth. The experiments were made at Toulon, upon cordage which had been six months exposed to the air, and an equal time immersed in the sea. We understand that the French Minister of Marine has introduced ropes and cables made of this material, into the Royal Navy, and as it is so much superior to hemp, we see no reason why it might not be advantageously employed in the cordage of the military and commercial navy of this country.—*Post.*

New Planing Machine.—We lately had the pleasure of seeing in operation a new and very curious, as well as effective machine for planing iron, invented and constructed by Mr. Rennoldson, of South Shields. The advantage obtained in this machine over others which we have seen, is that it cuts over the whole of the surface of the metal at once, whether it be one inch or 12 inches in breadth, with great ease; by which process, a very great saving in time is, beyond doubt, effected. It is extremely difficult to convey a correct idea of the manner in which this is effected without the assistance of diagrams. We can state thus far, however: the principal feature in which it is superior to others, is in the chisels or cutters, which are firmly imbedded in an iron roller about fourteen inches in length, and about three and a half inches in diameter. There are eight chisels in the circumference of this roller which extends rather more than half the length. The other end is furnished with an equal number, which likewise extend over a little more than half the length of the roller, and also intersect the position of the cutters in the opposite end, dividing the power which would be required to work it, it the cutters were as long as the roller itself. It is decidedly superior to the point for which a patent has been obtained, as it is calculated to do three times as much work, in a better style, in the same time.—*Tyne Mercury.*

Improved Sash and Table Fastening, &c.—By Thomas Hardeman Clarke, Birmingham, cabinet-maker, June 24.—In place of the ordinary spring bolt, the inventor adopts the use of a wedge formed bolt, which is urged backwards in the frame or socket attached to one window-sash, while the hasp or catch reaching from the other sash is held by this wedge-formed bolt. The same improvement may be applied to tables, but the position of the bolts must be varied, as circumstances may require.—*Inventor's Advocate.*

An improved apparatus for regulating the supply of water to steam-boilers, patented by James Knowles, Little Bolton, Lancaster.—Claims the use of a self-acting apparatus, the working parts of which are within the boiler, and communicate to the supply valve from without. A lever or rod is placed longitudinally on a fulcrum within the boiler, the longer end of which is an upright rod, with a float attached thereon, passing to the outside of the boiler; at the shorter end of the lever is another upright rod connected with the supply valve, working in a tube. As long as there is plenty of water in the boiler, the float will continue to press up the long end of the lever, and, consequently, cause the valve on the upright rod of the short end of the lever to press down on its bearing, and prevent the admission of water from the tank. But when the height of the water in the boiler diminishes, the float lowers with it, and thereby forces up the rod with the valve; thus admitting a further supply of water until the float again rises to close down the valve. —*Ibid.*

Improvements in reducing friction in wheels of carriages, which improvements are also applicable to bearings and journals of machinery, patented by Charles Greenway, of Douglas, in the Isle of Man, July 3.—The first claim consists in the method of forming a "cradle" for the reception of spheres or rollers, near to which, the arm of the axle is made to rotate, whereby a considerable friction is overcome, as the spheres or rollers do not require an axis, and the cradle is so formed as to keep them close to the axle.—In the description of the second improvement, the inventor states that to the carriage, on which the trunnions of a caronnade are usually fixed, wheels are not used, in order to prevent recoiling. But in his improvement, wheels are put to the carriage, so as to facilitate the movement of the caronnade towards the port-hole or embrasure; and before the act of firing, the caronnade with its trunnion is moved by the action of a lever from the carriage on to the deck of a vessel to prevent recoiling, and is again restored to the carriage by the same lever, when preparing to reload.—*Ibid.*

Improved mode of applying water-power, patented by Capt. George Davey.—The inventor claims the application of air jackets or chambers to a column of water, and the method of applying the power obtained by the pressure of the said column of water, through the medium of the compressed air contained in the said air jacket, whereby so great a quantity of air is driven into the working cylinder as to effect a great saving of water, which, in cases requiring a reservoir at a high level, is very important. An upright tube leads from the reservoir to the full extent of the fall of water; at each thirty feet this tube is surrounded by an air jacket, and three or four fine holes are made at the bottom of the tube, within the space covered by it. The lower part of the tube has a lateral connection with a small cylinder, with a double piston or dead boxes working therein. At the opposite side of this cylinder, there is a lateral connection with the working cylinder, that moves, by its piston and rod, the pump or engine. The water, passing from the reservoir, down the tube, forces a quantity of air from the air jackets, with the water, through the small cylinder (that has its double piston open) into the large working cylinder, by which means the piston of this cylinder is forced up; and the tappets on the rod of this piston are so arranged as to strike a lever connected with the rod of the double piston, which admits and shuts off the supply of water from the tube to the working cylinder. The piston of this cylinder being now forced up, the tappet on the rod causes the lever to put the double piston in such a position as to cut off the supply of water, until the water that is below the large working cylinder flows out into the waste, or discharging level. The piston with the rod, in descending, by its gravity, causes another tappet to strike the lever, and put the double piston or dead boxes, in the first position, in order to receive a fresh supply of compressed air and water, to set the piston in the large cylinder again in motion, which communicates its power to a pump or engine.

The "Eclipse."—A new iron steam-boat has just been completed by Messrs. John and Francis Napier, of Mill-wall, said to be decidedly the fastest steamer in England. She has made several experimental trips up and down the river, and from her surprising speed and singular appearance (having two funnels and the piston cross-head working above the deck) a report has got abroad that she is driven by high pressure steam This, however, is incorrect; she is propelled by *one engine* of 100 horse power, the cylinder is 54½ inches diameter, with four feet stroke; she has a double bottom, which gives increased strength and safety, and at the same time affords a large space wherein the steam is conveniently condensed, which keeps up a regular supply of fresh water to the boilers, saving nearly the entire power of working an air-pump. She has four separate boilers, any three of which are adequate to supply the engine; so that one may be repaired, &c., without causing any delay. The makers have met the report of "*high-pressure steam*" being used, by an offer to run the *Eclipse* against any steamer afloat, for any distance under 500 miles, with steam at a *lower pressure* than that of her opponent!—*Mech. Mag.*

New mode of propelling Steam Boats.—Falkirk, July 7.—An ingenious mechanic, residing at Grahamstone, has been for a long period engaged in constructing a small vessel to be propelled by means of pressure-pumps—the application of a principle quite new to the masters of this science. On Monday evening the boat was launched into the Forth and Clyde canal, at Bainsford-bridge, and proceeded beautifully along the reach at a rate of not less than 15 miles per hour, conducted alone by the inventor, who worked the pumps. This novel invention has produced much speculation among the members of the profession in this place, and it is now reported that he is so much satisfied with his first experiment, that another on a larger scale is forthwith to be undertaken, and a patent procured to protect the invention. He has no doubt that it will, at no distant era, entirely supersede the present mode of propulsion by means of paddle-wheels.—*Times.*

LIST OF NEW PATENTS.

GRANTED IN ENGLAND FROM 26TH JUNE TO 29TH JULY, 1840.

John William Nyren, of Bromley, Manufacturing Chemist, for "*improvements in the manufacture of oxalic acid.*"—Sealed June 26; six months for enrolment.

Thomas Spencer, of Manchester, Machine Maker, for "*a certain improvement or improvements in twisting machinery used for roving, spinning, and doubling cotton, wool, silk, flax, and other fibrous materials.*"—June 26; six months.

William Jefferies, of Holme Street, Mile End, Metal Refiner, for "*improvements in copper spelter and other metals from ores.*"—July 1; six months.

William Mc.Murray, of Kenteith Mill, Edinburgh, Paper Maker, for "*certain improvements in the manufacture of paper.*"—July 1; six months.

John David Poole, of Holborn, Practical Chemist, for "*improvements in evaporating and distilling water and other fluids.*" Communicated by a foreigner residing abroad.—July 2; six months.

Charles May, of Ipswich, Engineer, for "*improvements in machinery cutting and preparing straw, hay, and other vegetable matters.*"—July 6; six months.

Edward Turner, of Leeds, in the County of York, Engineer, for "*certain improvements applicable to locomotive and other steam engines.*"—July 6; six months.

James Harvey, of Bazing Place, Waterloo Road, Gentleman, for "*improvements in extracting sulphur from pyrites and other substances containing the same.*"—July 8; six months.

Louis Leconte, of Paris, but now residing in Leicester Square, Gentleman, for "*improvements in constructing fire proof buildings.*"—July 9; six months.

Joshua Taylor Beale, of East Greenwich, Engineer, for "*certain improvements in steam engines.*"—July 10; six months.

George Barnett, of Jewin Street, Tailor, for "*improvements in fastenings for wearing apparel.*"—July 11; six months.

Joseph Getten, of Paul's Chain, London, Merchant, for "*improvements in preparing and purifying whale oil.*" Communicated by a foreigner residing abroad.—July 11; six months.

William Palmer, of Feltwell, Norfolk, Blacksmith, for "*certain improvements in ploughs.*"—July 11; six months.

Peter Fairbairn, of Leeds, Engineer, for "*certain improvements in machinery or apparatus for heckling, combing, preparing or dressing hemp, flax, and such other textile or fibrous materials.*" Communicated by a foreigner residing abroad.—July 13; six months.

Thomas Tassell Grant, Esq., and Officer in Her Majesty's Victualling Yard, of Gosport, for "*improvements in the manufacture of fuel.*"—July 13; six months.

Edward Travis, of Shaw Mills, near Oldham, Cotton Spinner, for "*certain improvements in machinery or apparatus for preparing cotoln and other fibrous materials for spinning.*"—July 15; six months.

John Lambert, of Coventry Street, Saint James's, Gentleman, for "*certain improvements in the manufacture of soap.*" Communicated by a foreigner residing abroad.—July 15; six months.

James Jamieson Cordes, and Edward Locke, of Newport, Monmouth, for "*a new rotatory engine.*"—July 18; six months.

Moses Poole, of Lincoln's Inn, Gentlemen, for "*improvements in fire arms and in apparatus to be used therewith.*" Communicated by a foreigner residing abroad.—July 18; six months.

James Roberts, of Brewer Street, Somers Town, Ironmonger, for "*improved machinery or apparatus to be applied to the windows of houses or other buildings, for the purpose of preventing accidents to persons employed in cleaning or repairing the same, and also for facilitating the escape of persons from fire.*"—July 18; six months.

John George Bodmer, of Manchester, Engineer, an extension of a patent for the term of seven years granted to him for "*certain improvements in the machinery for cleaning, carding, drawing, roving and spinning of cotton and wool.*"—July 18; six months.

Robert Urwin, of South Shields, Engineer, for "*improvements in steam engines.*"—July 29; six months.

Alexander Angus Croll, Superintendant of the Chartered Gas Company's Works, in Brick Lane, for "*certain improvements in the manufacture of gas for the purpose of illumination, and for the preparation and manufacture of materials to be used in the purification of gas for the purposes of illumination.*"—July 29; four months.

Joseph Bennett, of Turnlee, near Glossop, in the County of Derby, for "*certain improvements in machinery for cutting rags, ropes, waste hay, straw, or other soft or fibrous substances usually subject to the operation of cutting or chopping, part of which improvements are applicable to the tearing, pulling in pieces, or opening of rags, ropes, or other tough materials.*"—July 29; six months.

John Swain Worth, of Manchester, Merchant, for "*improvements in machinery for cutting vegetable substances.*"—July 29; six months.

TO CORRESPONDENTS.

Books received:—Parts 2 and 3 of Ricauti's Rustic Architecture; Ibbetson on Turning, 3rd Edition, this work we before noticed as of one considerable interest to the amateur in Turning; Report on Steam Communication via the Red Sea, by W. D. Holmes, C. E.

Communications received from Pisiculus *on the Tides of the Ocean;* Mr. East; *and* Mr. Burstall *on his Locomotive and Marine Tubular Steam Boiler.*

An original Subscriber *will find in next months' Journal the information he requires on Wood Paving.*

A Comparison of the Rival "Screws" *will, if possible, be noticed next month.*

Mr. Pinkus *forwarded us a paper, which was too late for insertion, relative to our remarks on the Atmospheric Railway, given in the last months' Journal.*

"A Subscriber."—*We are happy to inform him, that as the Reform Club is approaching completion, we shall give engravings of the elevation, plans, sections, and a description of the building either in the next or following months' Journal.*

A constant Reader.—*We will endeavour at some future opportunity to obtain the information he suggests relative to Iron Sailing Vessels.*

A Student of Architecture.—*The work is not yet before us, we will when it is, attend to his suggestions.*

"Ajax, &c." *is mistaken.*

"A Student."—*We will enquire and announce next month, the regulation for obtaining admission to the Economic Museum, we believe it is not sufficiently advanced for its being opened to the public.*

"A Lover of Fair Play" *is unavoidably postponed.*

We have received a communication relative to the "Fire King" *challenge in last months' Journal; we very much regret, that in consequence of an overabundance of materials for this month's Journal, we have been obliged to postpone it; it contains an account of the run of its sister boat the* Glowworm *with the* Ruby, *wherein it appears that the glittering of the* Ruby *completely took the shine out of the* Glowworm.

W. B. C.—*We regret that the original copy of the article which appeared in the 29th number has been destroyed, as we feel satisfied that that part which he states was omitted in the Journal never appeared in the original, as we are always most desirous of giving the name of the architect of any public building, and also the amount of the contract.*

The communications relative to Herr Laves' Truss Beams, *will appear next month.*

Communications are requested to be addressed to "The Editor of the Civil Engineer and Architect's Journal," *No.* 11, *Parliament Street, Westminster.*

Books for review must be sent early in the month, communications on or before the 20th (if with drawings, earlier), and advertisements on or before the 25th instant.

THE FIRST VOLUME MAY BE HAD, BOUND IN CLOTH AND LETTERED IN GOLD, PRICE 17s.

⁂ THE SECOND VOLUME MAY ALSO BE HAD, PRICE 20s.

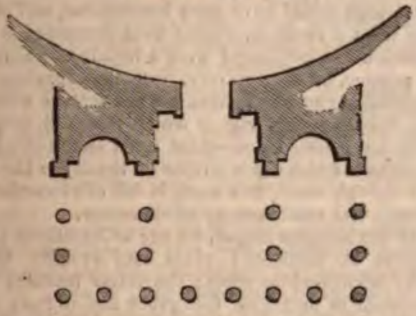
REMARKS ON ANTIENT AND MODERN PORTICOES.

Translation of some Remarks of Milizea, upon the Portico of the Pantheon at Rome, with general observations upon that feature in Architecture, including a notice of some of the Porticoes of London. By A. W. H.

To the uninitiated nothing may appear to be so easy as to compose a good portico; the fact, however, is exactly the reverse; the very simple and dignified character of its details, demanding consummate taste on the part of the architect to combine it with the peculiar style of the building to which it is to attach, and serve as chief ornament. The beauty which shines in the building should be still more apparent in the portico, which feature should become, as it were, the very focus of beauty, since, owing to its position in the edifice, it acts like the countenance in the human form, attracting the first glance, and recalling the last look of the observer; and, as the countenance reveals the mind, so this corresponding feature in a building, should bespeak *its* dignity and spirit; it is therefore manifest, that whatever difficulties may be overcome by taste in designing the body of a building, those difficulties become infinitely greater in the composition of its portico. Owing to the few parts of this architectural feature, and their striking character, it is necessary that the laws of harmony be rigidly observed; any, nay the least, infringement of those laws, leads in this instance to some glaring deformity. One must not, therefore, tamper with so difficult a subject, but recognise it as the legitimate patrimony of matured skill, as a feature which, whilst it spurns all crude attempts, affords, on the contrary, the finest opportunity for the display of real talent.

Besides, what charms in the associations, that sparkle from this gem of architecture! The sacred pageants of Greece and Rome, when seen arrayed within its precincts, appear in all their glory; from beneath the portico's grateful shelter, flowed with full effect the sources of ancient learning; from beneath its roof a Plato and a Tully spoke, and sages to debate, and crowds, thirsting for knowledge, flocked to the portico's genial shade;—seen, therefore, through the hallowed medium of the past, the *portico* rises to our view invested with all the charms of association, as the bewitching scenery which surrounded the ancient founts of wisdom.

Pantheon at Rome.



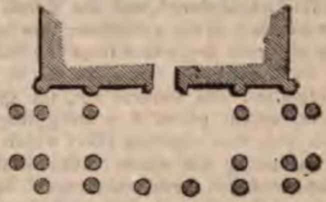
With so much, then, to give it effect, it is not too much to say that this feature demands the architect's chiefest care, and that every effort should be made to invest it with its wonted power, so that it may either strike with awe, attract through its richness and grandeur, be rendered imposing through dignified simplicity, or made captivating by its grace. Milizia, in speaking of the portico of the Pantheon, perhaps the finest specimen of the kind which has ever been erected, makes the following observations:—

"This portico," says that admirable critic, "all dingy as it is through the lapse of ages, its ornaments mutilated, the whole of the upper portion dismantled of its former richness, still expands the mind. It is simplicity itself." This last observation, upon a work which is abundantly rich, of the Corinthian order, and where the sculptor's mimic art appears to rival nature in the production of the luxuriant acanthus, recalls to mind the poet's invocation to that powerful attribute, when, addressing himself to simplicity, he says,

> "Though taste, though genius bless
> To some divine excess,
> Faint's the cold work till thou inspire the whole;
> What each, what all supply,
> May court, may charm the eye,
> Thou, only thou, canst raise the meeting soul."

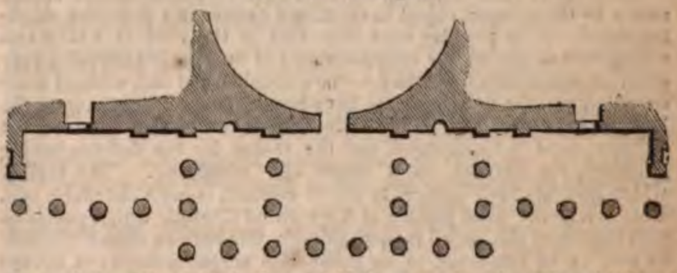
"A few columns merely, and a pediment, constitute this imposing mass, nothing more satisfactory than the straight forward character of its plan, so well adapted to the purpose for which it is designed, a passage to an entrance." It may here be observed, that viewed relatively to their position, the two internal ranges of columns gain great value in our estimation; they guide the visitor at once to the entrance of the sanctuary, who, but for them, might stray to the right or to the left of the immense area of the portico, and thus lose that high enjoyment now produced by the quick succession of strong and varied sensations, resulting from the contemplation of scenery at once so imposing and contrasting. It were in vain to attempt to describe the sensations produced by a visit to the Pantheon; those who have enjoyed so great a treat, will agree that such rapture must be experienced to be understood; such themes soar above mere prose, and, in attempting them, we feel that we are trenching upon the domain of the poet. The Roman critic continues thus; "the eye dwells with rapture on the justness of proportion of the various parts, those parts either taken separately, or in conjunction with one another. *Strength*, *richness*, *grandeur*, all the elements which constitute the beautiful, are here combined. Hence that possession which it takes of the mind! hence the universal admiration which it has ever excited among the intelligent! How inferior in their effect to this grand original are the porticoes of the Vatican, and many others attached to the basilicas of Rome, notwithstanding their artificial arrangement of plan, and prodigious efforts made to enrich them; but these lack the judgment which has presided over the distribution of the parts of the Pantheon portico. In this work the columns, though gigantic, appear of a proper size, whereas those of the Vatican always appear enormous; but in the Pantheon they are sensibly applied, inasmuch as they are admirably adapted to their office; to suppose the removal of one, would be annihilation to the whole design; whereas to remove almost all from many of our buildings (still referring to Rome), would be to rid these for the most part of some extravagant superfluity:" thus far our author. Nothing can prove more satisfactorily the merits of this portico, than the circumstance of the great Michael Angelo judging that no design could be conceived more appropriate for an approach to the first temple of modern times, and keenly must the lover of art regret that such an authority as the opinion of that great man should have been made to yield to the puerile conceit of a Carlo Maderno.

St. Geneviève at Paris.



While upon this subject, a feeling of regret also naturally suggests itself, that the architect of the Church of Ste. Geneviève at Paris, bearing, as he seems to have done, this fine portico in his mind, should most unaccountably have disdained to avail himself of its real merits, and by substituting a complicated arrangement of columns, thrown away the opportunity of producing a sublime effect, by aiming at the simplicity of this exquisite model. Nor can we compliment the architects (three in number) to the Capitol at Washington, upon the use which they have made of this grand Roman original; by what those architects have added and retrenched, they have come infinitely short of the effect which they might have produced. The additional side columns by apparently bolstering up the portico, sadly impair its vigorous aspect, and quite destroy the effect of its profile. Whenever such adjuncts are deemed necessary, it is preferable to make use of a square ante instead of a column to unite them with that portion which is more properly the *portico*; this not only gives solidity where it is wanted, but causes an agreeable separation of the side columns from the main feature, giving to the eye an opportunity of dwelling upon

Capitol at Washington.



the more striking portion of the front. The retrenching the depth, which leads from the centre portion of the portico to the interior of the building, must be considered as a great error, as it not only detracts from the solid appearance of the portico, but really weakens it, by lessening its hold upon the body of the building; this depth, too, is a source of much beauty in the composition, inasmuch as, by linking the portico with the chamber, to which the former is intended as an approach, it produces unity in the design, and gives to the portico the appearance of a feature of natural growth, just as in the human form we see the head shooting from the shoulders, connected with them, and gracefully supported by the neck. The architecture of the ancients is full of such propriety, doubtlessly owing to the enlarged and correct view which their highly instructed architects took of the subject,—and here it may not be amiss to touch upon the importance of the study of the human form to the architect, the necessity of which has been so strenuously advocated by the great professors of the art, the soundness of which advice we cannot but admit. The mind bent upon creating, cannot contemplate the wisdom displayed in the mechanism of the human frame, without imbibing lessons of the utmost value to its own productions; the treasures dug from so rich a mine of study by the architect, will go to teach him the importance of balancing the various parts of his design, and of blending them one with another in the plan, as well as in the elevations, so as to produce symmetry and proportion throughout, and to the end that his building may be solid in point of fact and in appearance, and that, numerous as the parts may be, they shall strike the beholder not so much as an accumulation of ideas, than as necessary features to the devellopment of one single thought, the which is so beautifully exemplified in all nature's works.

A glance of the porticoes which adorn our metropolis, may still afford pleasure and instruction, though the attention may have been recently directed to so exquisite a specimen as that of the Pantheon. They divide themselves into two classes; those which were erected at the period of the introduction of fine art into this country from Italy, and those which have been more recently built, and subsequently to the revival of the Greek taste. From its size, as well as from its merits, St. Martin's portico stands foremost amongst those which court attention. Its columns are massive and finely proportioned, and the capitals bold, and finely sculptured, and the detail generally evinces taste and study on the part of the architect; this portico recommends itself moreover, by its great projection from the face of the building, a requisite which should ever be a *sine quâ non* in the composition of this architectural feature. Its defects are, too great a distance between the columns, which gives it a straggling look, the which detracts very much from that vigorous effect which it would otherwise possess; its not extending the whole width of the building is not graceful, as on that account it seems not so much to grow out of it, as to be added to it; and the effect is also much impoverished through the wall immediately behind the columns not receding from the face of the two outer pilasters, and this wall or back part of the portico being crowded with parts, the which sadly interferes with the good effect of the columns; this is a defect which all the porticoes of that period partake of more or less. There is an adjunct to this portico which acts as a very great eye-sore, and the more so since present circumstances by no means sanction its continuance; the object alluded to, is the inhospitable iron railing, inserted between the columns through which the utility of the portico is wofully curtailed, inasmuch as the multitude, who pass to and fro, daily in that neighbourhood, are debarred the shelter which it would otherwise afford them, from the inclemency of the weather; the obtaining of which shelter should surely be the primary object in erecting a portico in a populous neighbourhood. It is possibly very true that at the time at which this railing was so placed, the neighbourhood of St. Martin's offered a very different scene from that which we now behold; and that without some such defence, the portico would have been exposed to injury, from the barbarous propensities of the rude frequenters of that quarter; but circumstances have changed, and the reason for the defence having vanished, the defence itself might also disappear. The feeling which protects such barriers to public comfort, is not a charitable one. Until lately the little portico of Vere-street Chapel, which possesses that important and useful requisite depth, was both an object of utility as well as of ornament, to its immediate neighbourhood; it offered moreover the additional attraction, of plants and flowers which a poor man used to sell, ranging his vases between the columns; the portico thus adorned became really a pleasing sight, it imparted cheerfulness to that portion of the street, which is itself quiet and retired; and offered a spectacle quite refreshing to the eye; besides the mind's eye being gratified by this picture of the church *sheltering*—not encouraging poverty. The charm has however been sacrificed, and the plants and their vendor have been driven from their sacred asylum, and, as a substitute, the inhabitants of that quarter, gaze upon an uncouth iron railing, introduced in a more barbarous manner, even than in the case with St. Martin's portico, since here, it is made to enclose the portico, steps and all, giving to that which looked free, and inviting, an imprisoned appearance.

A most peculiar portico, and one of a very striking character, and a great favourite with the Londoners, is that of St. Paul's, Covent Garden, the condemnatory terms even of a Quatremerè de Quincy, avail not in shaking our admiration of a work, so very characteristic of the bold genius of its author,—the learned Frenchman when mentioning it, indulges in a snarl at the English, and attributes their approbation of this work to their little oppurtunity of judging; London being, according to that learned critic, so barren of porticoes; an observation which either prejudice, or want of local information must have prompted it, for where is the city of modern times, that can vie with our metropolis in the possession of numerous admirable specimens of this fascinating feature in architecture? The propriety of applying so plain an order as the Tuscan, to a building of so exalted a character as that of a public place of worship, may admit of doubt, but that the effect of this portico is truly admirable, no unprejudiced person will deny; it possesses that essential feature *depth*, through which a portico appears to fulfil its apparent destination, that of affording shelter. The arched openings in the flanks present a bold and successful expedient in giving variety, where the stern simplicity of the building seemed to render the task hopeless—and, the few simple means, of producing picturesqueness are throughout skilfully applied. Who with a spark of sensibility in his composition, can gaze upon this building, and not feel that it is the work of a painter turned architect! This portico appears to great advantage when seen in conjunction with the crowds which assemble about it at the time of an election in the market-place; its grave and solemn aspect shed additional interest over the important scene, the whole realizing to the painter's eye and patriot's heart, a soul-intrancing picture, and one from which the enlightened mind reaps aid in its conceptions of kindred scenes, once enacted in the far famed Roman Forum.

In the portico of the East India House, we perceive a new era in taste, it displays the refinement of Greek feeling; but through the want of that great requisite depth it is scarcely entitled to the appellation of portico; for it presents nothing more than a graceful architectural frontispiece; and more graceful would it be deemed, if the pediment had been suppressed, and the cornice been horizontal, because then the design would have been harmonious, and it would have appeared to be what it really is, a mere front decorated with columns; for the introduction of a pediment over a façade of columus far from constituting a portico, on the contrary, becomes offensive, inasmuch as it imparts superfluous energy of character to a feature which lacks that balancing and corresponding vigour which it would acquire through depth. It were impossible to comment upon any portion of the East India House, without speaking in praise of the little Doric portico at the east front; though small, this work is full of attraction, abounding in grace, delicacy, and much energy of character.

In the front of the Mansion House, we see a Corinthian portico raised upon a basement of rusticated piers and arches; this certainly produces a very inharmonious effect; the latter features being of too ordinary a character to suit with the grace and dignity of the Corinthian order. There is in this composition another very glaring defect, viz., the portico leading to nothing; for the hall to which it leads from the street, instead of being of ample dimensions with the portico, is low and contracted. A stately portico should not lead to mere chambers, when it is necessary to have recourse to such economy in the interior, it is ostentation to apply so magnificent a feature, as the portico externally. The very effect of a portico is to exalt the ideas of the spectator, which become suddenly depressed when he least expects it, if it lead not to some feature of corresponding grandeur. Like persons, buildings should not promise more than they perform: and generally, the ideas raised by the external appearance of a building, should be realized in its interior.

In the Corinthian portico of St. Georges, Hanover-square, the order has been well attended to, and much vigour is produced by the columns being comparatively closely placed, the centre opening is somewhat wider than the rest, which is very admissible.

There is something very noble about the portico of St. Georges's, Bloomsbury; the order is boldly treated; and the deep tone of shadow obtained by the great projection from the line of wall, gives to the front columns a fine relief; but it is difficult to comprehend, how a pupil of Sir C. Wren could introduce columns attached to the wall and corresponding to those in front, thereby repeating in the back ground, the front part of the picture, which is surely as absurd in architecture, as it would be deemed in painting.

These porticoes and many others which adorn our metropolis, possess very great merits; and it is cheering to reflect that with the exception of one or two instances they display originality of thought, and that they are modified by circumstances peculiar to the buildings to which they attach; thus they afford us valuable lessons. A question seems here to arise, how is it that these porticoes, having so many claims to our admiration, are not oftener the theme of praise? The reply naturally is, that they have to contend against very overpowing circumstances; they are generally in confined situations, and much discoloured. It would seem from their being so placed, concealed and incumbered by buildings often of the meanest description, that great indifference must have prevailed towards art in general, at the time at which they were erected, and, that but little sympathy could have been entertained for the feelings of an artist, anxious about the effect his work was calculated to produce. We have to congratulate ourselves that the times in which we live, bear the stamp of a more enlightened and liberal sentiment.

As much solicitude is now shown in rescuing former works from oblivion as in erecting new ones; and London in its present stage may be compared to an old picture, in the hands of an intelligent repairer, to which the latter not only adds fresh parts, but is equally intent in giving value to its concealed beauties, by dexterously removing the excrescences of time and neglect. But there remains yet to be mentioned, a cause still more powerful in diminishing the effect of our porticoes, than any yet alluded to, viz., the tower, which becomes a real deformity, when seen rising immediately over the roof of the pediment. This feature so capable of being rendered beautiful when philosophically treated, becomes a positive eye-sore when seen shooting out of the roof of the pediment, and interfering with the severe and classical form of the latter; thus placed it produces all the deformity of a hump upon the back; and yet despite the incongruity resulting from this peculiar disposition of the tower and pediment, it has been persisted in by the generality of our architects, in spite of the better example shown us, by our immortal countryman Sir C. Wren, and his immediate followers. The system which the Italians have adopted, in disposing of these two features, which modern custom has rendered it necessary to combine, shows their nicer discrimination of the true principles of beauty. They have felt, that the forced contact of two elements, whose characteristics are so diametrically opposed—the perpendicular predominating in the one, the horizontal in the other—could not but be productive of an inharmonious result, and, have therefore invariably placed the tower at the end, or on the flank of the church; thus not only, is no unpleasant sensation created, but additional beauty results from this disposition, in the charm which both features give through an *agreeable* contrast.

St. George's, Bloomsbury, affords a striking instance of the last-mentioned method of treating the subject in question, and however opinions may differ with respect to the design itself, people of taste are unanimous in their approbation of the system which the architect has adopted, of combining those two important features, the portico and tower.

The following remark from the late Mr. Thomas Hope, is quoted as an introduction to some general observations respecting porticoes. Touching the important requisite *depth*, that author says, "a portico thus constructed becomes in the first place an object of real utility; it fulfils its apparent destination, that of affording shelter to the pedestrian, and screening the inhabitant waiting for the hour of prayer from the inclemency of the weather; it becomes in the second place a means of infinite beauty, and gives at once to the individual columns, more relief, more distinctness, and consequently more effect, through the deep shade it throws upon the wall behind; and to the entire façade, more motion, more picturesqueness, and more dignity."

Touching the utility of porticoes, it may be permitted to remark upon a fact connected with their projection from the face of the building, upon which circumstance so much of their utility depends; it is then quite consistent with good taste to give to the portico, if required, a projection greater than one intercolumniation, without placing any column in the return; owing to want of attention to this circumstance, it is not unfrequently seen, where the projection is a little more than one intercolumniation, that the intercolumniation itself is made out by a column, immediately behind which is placed the ante; a proceeding which produces the very reverse of a good effect; for the contrast of the cylindrical form of the shaft of the column, with the square form of the ante, pleasing when the eye is enabled, by a proper intervening space between them, to glance gradually from one to the other, is quite grating to the sight, when thus made sudden, by the almost immediate contract of features so dissimilar,—besides that, this union of column and ante, by producing irregularity in the distribution of the points of support, gives to the portico an appearance of weakness. This observation is of value to the architect who is desirous of making his portico an object both of utility and beauty; for in extending it across the foot-path, additional, and very requisite, shelter is afforded, and much picturesqueness is also produced by thus gracefully breaking the necessary long line of street architecture. The beautiful portico of Hanover Chapel, in Regent-street, those of the Haymarket Theatre, and Melbourne House, Whitehall, favourably illustrate this position.

A very important item in the composition of a portico, is the back ground, or wall immediately behind the columns,—this line of wall should always be made to recede, and if possible considerably from the front line of the ante, for by this means a deep tone of shadow is secured for the relief of the columns in front. It is not possible to admire too much the painter-like feeling displayed in this respect, in the above mentioned exquisite portico of Hanover Chapel, where the effect at night seems to have been a matter of study, as completely as that by day: the lamps within the portico are so happily placed that in two corresponding points of view they become concealed from the eye of the observer, who freed from their glare, contemplates more willingly the columns, which tell out in the picture, as dark objects, relieved upon a back ground of subdued light. It is important too that in this portion of the portico there should be as few lines as possible, at all analogous to those of the columns; all perpendicular lines should therefore be avoided; the introduction of pilasters behind the columns, according to the Italian school, is a vice in composition; they only tend to produce monotony and confusion, by repeating and interfering with the front lines of the portico; the obtaining of horizontal lines on the contrary should be aimed at as these by contrast, set off the columns well, especially if the latter be fluted.

The porticoes of the Greeks and Romans, are admirable in the conduct of the back ground, and in this feature we, who keep more to the ancients, greatly excel our ancestors, who designed more immediately in the style of the Italians, the back grounds to whose porticoes are oftentimes positively vulgar. The two celebrated circular temples of Vesta at Rome, and at Tivoli have no pilasters corresponding to the columns, which latter features thus unembarrassed, produce a striking effect. Bramante, that great master of the art, did not escape from this vulgarism, and has greatly impaired the effect of his well known little circular temple at San Pietro, in Montorio, by the introduction of these worse than useless appendages, pilasters.

Aspect is another grand consideration in the application of a portico; no portico should have a northern aspect, unless it have at the same time a famous projection. The grand portico of Rome, the front of which is due north, reads us a valuable lesson upon this point; it projects no less than three intercolumniations from the face of the wall, consequently twice in the day it receives abundance of sunshine, owing to which circumstance it never wears a gloomy appearance. Sunshine is to a portico, what a smile is to the countenance; though neither of the attributes be visible for the moment, their genial influence is ever apparent. A portico from the very boldness of its parts, and peculiar plan, being well calculated for a sunny effect, becomes on the contrary, a most gloomy object, if never enlivened by the the sun's rays; to wit, that dull looking portico affixed to the end of the College of Physicians. In the first place, the aspect of this portico is north, and stuck as it literally is against the wall, it remains throughout the year a complete stranger to the sun's rays; this portico never wears a smile, but cold, chilly and repulsive, even in the brightest season, it has the appearance of labouring under a fit of the dumps, and presents the novel spectacle of a portico requiring the physician's aid; its gloomy appearance offers a strange contrast to the gay scene around, whilst its oblique position, one can imagine it to have contracted from a habit of darting, side-long wistful glances at the sunny, cheerful faces of its neighbours, of the National Gallery and St. Martin's.

Surely it is a strange anomaly, that a conspicuous part of a building, which, from its destination of College, of the guardians of the health of the public, is so rife with associations of a cheering nature, should assume so dreary a look. The Faculty must not be surprised, should any one imagine them, to have laboured under a heavy attack of the portico-mania, when they pressed this woeful-looking object into their service, standing as it does, without reason, rhyme, or sunshine. And singular to observe, another branch of the healing profession, exhibits strong symptoms of having laboured under the same curious malady; the Royal College of Surgeons having, as it were, by hook or by crook, possessed themselves of something of the portico kind, in the shape of four columns, with a bit of an entablature pasted against the wall, affording no shelter, but screening the light, amputation here would be of use, for if the well known Italian question were put to these columns, of "Care colonne, che fate quà?" they might be excused answering, "non sappiamo in verità."

Touching the forms of porticoes, it may be observed that the number of columns should be in such proportion to the height, and perameter of the portico as to display at once its form, without the necessity of the eye glancing to the steps, or to the entablature, in order to descry it. Great attention should be paid to this point, in designing circular porticoes, for, if the columns be scantily introduced, a doubt is raised in the mind as to whether the portico is polygonal or circular; and then the eye is distressed at the awkward appearance, portions of the architrave assume, in overhanging between the intercolumniations. A portico formed of a double tier of columns, viz., one tier above the other, produces by no means a happy effect, owing to its somewhat ricketty appearance, columns forming but a poor foundation to one another. Grouped columns, commonly called coupled columns, are wholly inadmissible in a portico. So licentious a system of composition but ill comports with the simple character of that feature, which should display architecture in all her severity. There is then no feature in his art, touching the effect of which a true architect will feel more solicitous than that of the portico; for well does he know, that the few, but striking members, which unite in the formation of a well designed portico, captivate the mind, whilst ravishing the eye of the spectator; just as in writing an elegant assemblage of words, conveying a simple thought, arrests and charms the mind of the reader.

ON MALLEABLE IRON IN PERSIA.

An Account of the Iron Mines of Caradogh, near Tabreez in Persia, and of the Method there practised of producing Malleable Iron by a single process directly from the Ore. By JAMES ROBERTSON, *Civil and Mining Engineer, Major Persian Service, and late Director of the Shah's Ordnance Works, Persia; Cor. M.W.S., and Cor. F.A.S.S. Read before the Royal Society of Edinburgh, March* 2, 1840.

THE ancient Greeks have laid claim to the earliest discovery of the method of manufacturing iron, but it will appear that the art was known in Persia at least as early as among the Greeks. The method of producing malleable-iron by a single process directly from the ore, is not indeed quite unknown at the present day, but it is believed to be altogether disused in Great Britain and throughout Europe; but there is no doubt that, in Britain, particularly at Castle Cough, Glamorganshire, and at Furness, near Ulverston, in Lancashire, as well as elsewhere, malleable-iron must have been known long before the discovery of cast-iron. In the 17th century, malleable-iron appears to have been made directly from the ore, in preference to the method now practised. In the Philosophical Transactions (for 1693, vol. xvii. p. 695), there is the following short notice by Mr. Sturdy, of the method as then practised at Milthorpe-forge in Lancashire. "The forge is like a common blacksmith's, with a hearth made of sow-iron, in which they make a charcoal fire, *and put in ore*, first broken into pieces like a pigeon's egg; it is melted by the blast, leaving the iron in a lump, which is never in a perfect fusion; this is taken out and beaten under great hammers, played with water, and, after several heatings in the same furnace, it is brought into bars. They get about one hundred weight of metal at one melting, being the produce of about three times as much *ore*; no limestone or any other flux is used." It has been doubted by an intelligent author (Farey on the Steam Engine, p. 271), whether, by the process here described, the iron was really made directly from the ore, or only from pig metal. The existence, however, of a similar process at the present day in Persia, evidently the same which has been practised in that country from a very remote period, will make it appear not the least improbable that iron may have been thus produced from the rich hematite or fibrous red iron-ore of Lancashire.

The writer of this paper having resided for more than two years in the neighbourhood of the Persian mines, and having been during that time engaged in superintending the manufacture of cast-iron, trusts that the following short account of the mines, and of the very primitive process of the iron manufacture, which came constantly under his observation, may be found interesting, if it be not also of some practical advantage, even where the manufacture is conducted with all the refinements of modern scientific improvements.

We have no historical record from which to ascertain the period at which the iron mines in the district of Caradogh were first wrought. But there is every reason to suppose that they were resorted to from the remotest antiquity. The district itself is very secluded, and is of a wild, forbidding aspect; it has, without almost any interval, formed part of the Medean, and latterly of the Persian empire; and, under the rule of native princes, has all along been free from the revolutions which have so frequently convulsed Western Asia. The iron mines themselves also bear evident marks of antiquity. They form large quarry-like excavations, thickly surrounded by immense tumuli of iron-sand and small pieces of ore, thrown out in the course of working. Upon a rough calculation, founded on the size of the excavated hollow which it exhibits, one only of the numerous iron mines which abound in the district, was estimated by the writer of this notice to have now afforded above 4,000,000 cubic feet of iron-ore. Taking the specific gravity of the ore at 5, a cubic foot would weigh about 300 lb., and consequently seven cubic feet would weigh about a ton; and 4,000,000 cubic feet, the total quantity excavated from that mine, would weigh 571,428 tons. Now, at the present day, 2000 horse loads is a full allowance for the yearly quantity carried away, and as each horse carries about 2 cwt., we have a total of 200 tons per annum as the exported produce at present. It may be reasonably assumed, that this quantity has, upon an average, never been exceeded during the many ages in which the mines have been wrought. Indeed, this estimate certainly exceeds the actual average yearly produce; for although a considerable quantity of Russian iron is now imported, to supply the increasing wants of the inhabitants, it cannot be imagined that, in periods of their early history, the natives would require nearly so much iron as they now do. Upon that assumption and without taking into account the other neighbouring mines, it would follow that 2857 years have passed since the soil was first removed from the surface of the mine alluded to. Were the other neighbouring mines taken into account, the antiquity of the whole would be proportionally increased. The writer has not by any means stated these as calculations, or as at all approximating to accuracy, but still he thinks that, from such data, fanciful as they may in some measure appear, an estimate may legitimately be formed on the very great antiquity of the Persian mines.

The native smiths are dispersed in small hamlets, situated in the woods which clothe the sides of the ravines, through which the mountain torrents flow into the river Arras (the ancient Araxes). The iron which is produced, although soft, is extremely tough. It is much superior to the Russian iron, with which the greater part of Asia is now supplied, and is manufactured chiefly into horse-shoes, and horse-shoe nails, for which there is a great demand in Tabreez and the surrounding districts, and among the Koords or Nomadic tribes who frequent the mountain pastures in summer. The trade in it is shared between the Mahomedans and the native Armenians; and although by no means extensive or deserving the name of the "Persian iron trade," it gives employment to a considerable part of the population, in quarrying the ore, burning the charcoal, and transporting these articles to the forge.

There are numerous mines in Caradogh, affording iron-ore of the most valuable description, and of various kinds; but those held in the highest estimation are the Jewant, Koordkandy, and Marzooly ores.

The Jewant mine is situated in an immense vein of red iron-ore. This ore, on its fracture, often exhibits streaks of prismatic colours, as if at one time it had been subjected to the action of heat; quantities of iron-sand are dispersed in the interstices of the vein.

The Koordkandy mine, situated on the summit of a very steep mountain, produces rich magnetic iron-ore, from a vein of great dimensions. The Marzooly mine also affords excellent magnetic iron-ore in great abundance. The vein in which the last is situated runs across several hills, and is in most parts 100 feet in width.

In working these mines, the richest pieces only of the ore are carried away, the remainder is thrown aside. They are worked very irregularly, and without concert, as there is no restriction imposed as to the mode of mining by the Government. A few individuals sink a shaft through the rubbish, and excavate as much as they require; another party soon after arrive, and fill the first hollow up in the course of sinking another shaft; and in this way the rubbish is repeatedly turned over, and gradually subsides and is consolidated into a mass as the ore is removed from beneath, thus forming a serious obstacle to any one who might attempt to work the vein in a more regular manner. The ore is carried to the villages only during the summer, as the depth of the snow in winter renders the mountain paths impassable. It is there retailed to the smiths, who purchase a horse-load of 2 cwt. for about 1*s*. sterling, or 10*s*. per ton.

The ores above described, when smelted singly, produce that kind of iron which by English workmen is called *hot-short*, and by the Persians *salt-iron*. The smiths, however, by means of a mixture, produce iron of an excellent quality, which they term *sweet-iron*. The most common mixture is two parts Jewant ore to one of Koordkandy, and two parts of of Koordkandy to one of Marzooly.

Materials for smelting the ore are found in an extensive natural forest which occupies the natural parts of the district of Caradogh. This forest covers the flat bottoms between the mountains, and spreads to a considerable height up their sheltered sides, dwindling into dwarf trees and bushes in the elevated and more exposed situations. It consists chiefly of coppice oak, which springs from the roots of trees cut and recut during a long succession of years. This jungle is partitioned among the villages situated on its confines, the inhabitants of which earn a livelihood by supplying the city of Tabreez and adjoining towns with fuel.

The charcoal is made in the following manner: a rectangular hollow is dug in the earth, about twelve feet long, six feet wide, and four feet deep. The sides are formed of the natural ground, or common alluvial cover; a small sloping doorway is cut at one end, and at the other a chimney is built rising to the height of about six feet. The pit is filled up to the level of the ground with cut branches of all dimensions, placed horizontally and lengthways in the hollow, and are covered over with earth, and secured effectually against the admission of air, excepting by a small hole in the built-up door-way, which is left open to produce a current; the heap is kindled through the small opening in the door-way, and after it has burned for two or three days the covering is removed, and the charcoal thus produced is then stored for sale. One of these hearths will produce about one ton of charcoal, which sells at thirteen shillings sterling.

The charcoal thus produced, however, is seldom used in the manufacture of iron, the smiths preferring that prepared in the following manner: the cut branches are merely laid horizontally on the surface of the ground, and piled up to a considerable height; having been lighted from beneath, they are allowed to burn in the manner of an open fire, till the smoke and flame have nearly ceased; the fire is then quenched with water, when there remains a charcoal which is very light, and is found to reduce the ores of iron in a much less time than the heavier charcoal produced by the first method.

As the iron is manufactured on a very small scale, a very simple forge answers the purpose. It consists merely of a hollow hearth dug out of the clay floor of the hut, about fourteen inches square in the bottom, and nine inches deep, for receiving the ore and fuel; and of another hearth immediately thereto adjoining, intended to receive the slag, and consisting of a larger excavation, about three inches deeper than the former, and situated betwixt it and the wall at the other extremity in which the chimney is constructed. A wall is built on each of the two sides, two or three feet high, and the whole is covered over with large stones capable of resisting the action of the fire. The whole of the first or iron-hearth into which the blast is introduced is left open above and at the sides; but a low wall is built next the bellows to prevent the heat from injuring them. The whole is afterwards plastered over with clay and chopped straw, in order to maintain the draught of the chimney entire. The chimney is carried up through the wall of the hut, and seldom rises higher than its roof.

The construction and dimensions of these hearths will be best explained by the accompanying drawings.

Fig. 1—Vertical Section.

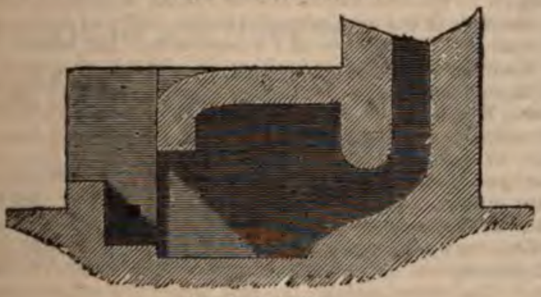


Fig. 2—Side View.

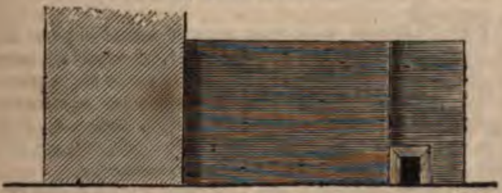


Fig. 3—Side View.

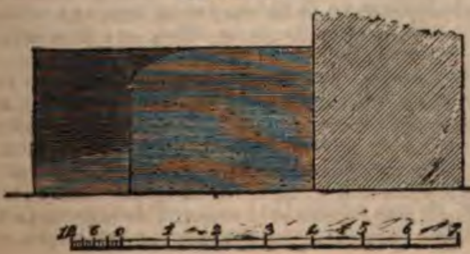


Fig. 4—Ground Plan.

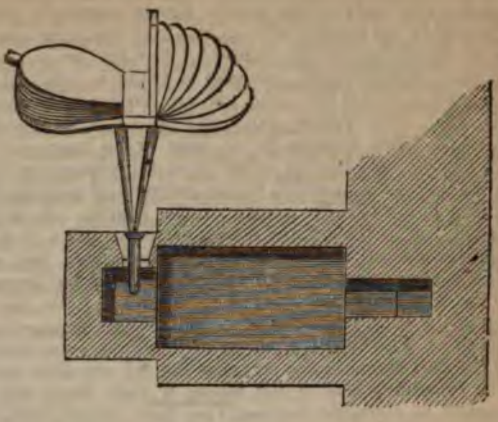


Fig. 5—End View.

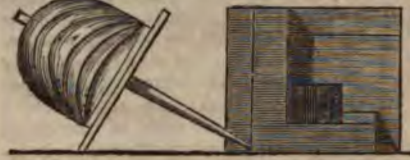
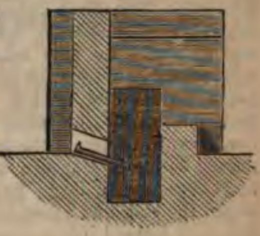
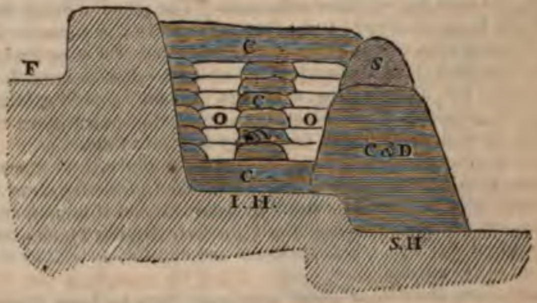


Fig. 6—Section of Ore Hearth.



The operator having carefully selected charcoal of a small size and light weight, proceeds to clear it from dust and sand with a small meshed riddle, removing all the heavy pieces of charcoal or stones that may be accidentally mixed with it. The raw ore being next selected and mixed, and being broken into small pieces about the size of a hazel nut, is thoroughly moistened with water. A dam is then made between the iron and slag hearths, composed of charcoal and charcoal dust well rammed down, and the top is coped with iron slag from a former smelting. The following sketch will show this arrangement:

Fig. 7.



References.—I. H. Iron Hearth.—S. H. Slag Hearth.—C. and D. Charcoal and Dust.—S. Slag.—C. Charcoal.—O. Ore.—F. Floor.

The Twyére pipe, which is made of white clay, and bears a violent heat for a long time without melting, is then inserted through the small hole in the side wall of the first iron hearth. The point of the pipe is made to reach half way across the iron hearth, and within six inches of the bottom, as shown in Fig. 6. A layer of charcoal, of three inches thick, is then spread over the bottom of the iron hearth, and upon this two other layers laid across, one directly under the Twyére pipe of about six inches in breadth and three inches deep, and the other at the front of the hearth of the same thickness, to correspond with the overlying part of the dam. The two trenches which are thus formed are filled up with the moistened ore, well rammed down. A second layer of charcoal, in a state of ignition, is thereafter laid over the former under the twyére pipe, and other successive layers of charcoal and ore are filled in, corresponding with those in the bottom.

When the hearth has been nearly filled up in this way, a covering of charcoal is spread over the surface of the whole on a level with the top of the dam. The bellows are then blown, and a workman, who stands at the side of the hearth, keeps constantly pushing down the charcoal in the middle with an iron rod, and from time to time throws small quantities into the centre of the fire as it gradually subsides. At the commencement, one man at a time is sufficient to blow the bellows, but, towards the close, two are required, the one standing behind the other. The bellows shown in Figs. 1 & 5, are in general use all over Persia. After blowing for an hour or an hour and a half, part of the twyére pipe having melted from the violence of the heat, the blast is stopped for a moment, for the purpose of pushing the twyére pipe farther in towards the centre of the hearth. It is then again continued, and in about three hours, or three and a half hours from the commencement, the ore becomes consolidated, but not fused. The blast is then again stopped until that half of the bloom which is next to the slag hearth is turned over with an iron bar, and pushed on the top of the dam, while the other half is turned round to the centre of the fire. The blast is then immediately recommenced, and the metal of the half bloom in the centre of the fire speedily falls to the bottom. The remaining half of the bloom is then drawn into the centre, and treated in a similar manner, very little charcoal being placed on the top of the fire during this part of the process. When the metal has entirely disappeared by sinking to the bottom of the hearth, the whole semifluid mass is stirred about for a quarter of an hour longer with an iron rod. The blast being then stopped, the twyére pipe is withdrawn, and the operator taking his shovel, pushes the burning charcoal together with the dam into the lower hearth; the slag immediately runs off, and exposes the glowing iron lying in the bottom of the upper hearth; the metal is then beaten with the back of the shovel into a more solid state, and after being dexterously cut with an iron chisel bar, from the sides of the hearth, and forced from the bottom, it is removed to the floor of the hut with a large pair of tongs. The iron is next beaten with large hammers as it lies on the ground, in order to expel the slag and other impurities from its pores; and after being in this way formed into a rough mass, it is lifted to the anvil, when it is again hammered into a more regular shape. It is next cut into two pieces with large hammers, and is then fit for being drawn into bars of the dimensions required.

At a single smelting, one hearth generally affords about 30 lb. of malleable iron, to produce which there is only required about double that quantity of ore, and three times the weight of charcoal. One smith with his assistants will make about three or four smeltings in one day, or one cwt.

It must strike every one acquainted with the iron manufacture, that this *yield* is in a high proportion to the materials used. In England, about four tons of raw ore and eight tons of coal are required to produce one ton of bar-iron; while, by the process above described, the same quantity of iron, of a much superior quality, is produced in Persia from less than half of these materials. The greater productiveness is no doubt to be attributed in a great measure to the superior richness of the Persian ores, and the use of charcoal; but the simplicity of the process must also have a considerable share in diminishing the waste of materials; for the roasting, smelting, refining, puddling, shingling, balling, and drawing-out, or something very similar, is all there effected, as it may be said, at one heat, and in a very few hours.

The rich iron-ores of Cumberland and Lancashire, and many others in Britain, particularly the blackband ironstone of Scotland, which has so recently attracted the attention of iron-masters, if manufactured in the same manner, would undoubtedly produce similar results, and thus create a great saving in time, labour, and capital, as well as diminish the waste of materials.

In conclusion, the writer would beg once more to draw attention to the fact that malleable-iron can be readily made directly from the ore, contrary to what he believes to be the prevalent opinion in this country.

Since writing the preceding, the writer has had an opportunity of becoming acquainted with a similar process to the one already described, now successfully practised near the town of Malatia, on the Syrian frontier, in the central parts of Asia Minor. The iron-ores in this district are of the richest description, and were examined by the writer at the command of the Turkish government, with the view of establishing iron-works on the scale of British iron-works, for the supply of the Turkish ordnance. The method there pursued is, if possible, still more simple than that of the Persians, as the furnaces are in the form of a small cupola, and the fuel is simply dry wood.

SUTCLIFFE'S PATENT ROTATORY PUMP.

Sir—I take the liberty of forwarding you the enclosed engraving of a rotatory pump, in which you will perceive Mr. Sutcliffe is completely anticipated, and evidently (from the apparent age of the print) by many years. The coincidence between the two is more than remarkable, and I can but regret the want of the letter-press to accompany and explain; of this, however, you (and your readers, if you think fit to publish it,*) will judge. It is a French invention, and I consider, abandoned by our neighbours on account of its very great friction, and the difficulty there must exist in preserving, for any considerable time, the working surfaces in perfect contact. The ends or water-tight points of the ellipse experiencing so much more wear than the same extent of surface in the surrounding cylinder, or chamber.

If Mr. Sutcliffe, or any person from him, wishes to see the print, I will lea it with you for a time for that purpose.

A.

---

* [We have not thought it necessary to give the engraving, as it is so identically the same in principle as that of Mr. Sutcliffe's. The engraving, we should say, is at least 100 years old; it may be seen at our office.—Ed. C. E. & A. Journal.]

ADCOCK'S PATENT FOR RAISING WATER FROM MINES.

The very peculiar and extraordinary degree of novelty exhibited in this process of raising water, and the high degree of importance attached to it by many of our engineering and mining friends, has induced us to open a correspondence with the patentee, who has forwarded to us drawings and a description, which will fully explain the invention.

It may be necessary to state, as the apparatus is for *raising upwards*, many of our readers may have a very inadequate idea of the effect which it produces, and comparing it with the velocity and quantity of rain descending from the clouds, may conceive its effect, as practically inefficient. And so unquestionably it would be, were the cases at all analogous. But in the apparatus erected at the works of Messrs. Milne, Travis, and Milne, at Shaw, where the pressure of the air was a ninth part of a pound upon the inch, the velocity of the rain upwards, and its abundance were such, that if the rain were to descend from the clouds with equal velocity and in equal abundance, it would cover the earth 18¼ feet in a single minute of time. While, on the contrary, it is well-known that the quantity of rain falling in the metropolis in a year, is not more than 22 inches.

To prove what we have here stated, we have only to detail the following:

The diameter of the up-cast pipe at Shaw, was 14½ inches = 165 inches area.

Therefore the number of cubic inches in 1 foot of depth = 1980.

And through that pipe 130 gallons per minute were carried up 120 feet in height.

And each gallon contains 277·274 cubic inches.

Hence, 130 gallons × 277·274 ÷ 1980 = 18¼ feet, in depth.

Clearly proving what we have stated, that in a single minute, the earth would be covered rather better than 18 feet in depth.

Most probably we shall resume this subject in our next month's publication. In the meanwhile we shall give Mr. Adcock's description of the apparatus.

(Communicated by the Inventor.)

By the present modes of raising water from Mines and other deep places, by pumps and pump-rods, and other mechanical contrivances, the water is raised through a series of pipes, in a compact or solid state; in other words, if the depth through which the water must be raised, by a pump or one lift, be 100 feet, then the pipes, extending to that depth, will be full of water, and the whole column of water in those pipes will be lifted at one and the same time.

A column of water 100 feet deep, presses with a force of about 45 pounds on each square inch of its base. Hence, if the diameter of the pump-bucket, or plunger, be 12 inches, and its area, as a consequence, 113 inches, the weight of water to be lifted, *at each stroke*, will be about 5085 pounds.—In a deep mine, therefore, containing 10 such columns or lifts of water, below one another, and acted on at the same time, by the same pump-rod, extending down the shaft or pit of the mine, the weight of water to be raised will be very great, being not less than 50,850 pounds, or about 23 tons. Hence, to lift such weight of water, and to overcome the friction of the water in the pipes, together with the *vis inertiæ* to put such columns of water in motion, and to support its own weight, the pump-rod must be made of great strength; and the steam-engine, water-wheel, or other prime mover, head, above the termination of the air-pipe *a a*: it is there met by the ascending current or stream of air; it is dispersed into drops, and carried up by it, in the manner herein-before made known.

It should be stated that, in mines, and other deep places, where the water may accumulate and rise to some height in the pit or shaft, from the stoppage, by accident or otherwise, of the steam-engine, water-wheel, or other prime mover, or from other causes, I introduce a stop-cock, or other contrivance adapted to the purpose, to regulate the passage of water into, or to exclude it from, the pipe *b b*. I effect this, by putting the apertures aforesaid in connexion with, and in making them receive their supply of water from, a pipe to which such stop-cock is applied. I attach to this stop-cock, or other contrivance, a rod of wood or metal, of sufficient length to rise above the surface of any water that thus may accidentally accumulate in the shaft or pit, and of sufficient strength to enable the workman to open and shut the aperture of the stop-cock, or other contrivance, by it.

It is essentially necessary that this should be attended to, as otherwise the water, or other liquid, may accumulate and rise to such a height in the pipes *a a*, *b b*, as may prevent the passage of the air from the pipe *a a* into the pipe *b b*, and thereby stop the action of the apparatus. For a similar reason, the water or other liquid must never be allowed to stand at a higher level above the end of the pipe *a a*, than the pressure of the condensed air can displace; and to effect this, the reservoir *c c* must be so proportioned to the lower part of the pipe *b b*, that whatever number of inches the water or other liquid may descend by the pressure of the air in the one, it may ascend to an equal number of inches in the other, as in the two limbs of a syphon or bent guage; and to guard still further against the chance of any interruption of the process, either by an accumulation of water in the mine, as aforesaid, or by an imperfect state of the stop-cock allowing a portion of such accumulated water to flow past it into the lower parts of the pipes *a a*, *b b*, I connect with the lower parts of such pipes a small pump, to be worked by the hand of a workman, and rising sufficiently high in the mine to be above the surface of any water that, perchance, may thus accumulate. By such pump, the workman, labouring but a few minutes only, will be enabled to withdraw the water or other liquid from the pipes *a a*, *b b*, and such liquid will be discharged by him, not at the top of the mine, or at the adit, but back again into the shaft, that it may be subsequently raised by the ascending stream of air.

In applying my invention, in practice, I sometimes cause the water, or other liquid, to flow into the *up-cast* pipe, in any given time, in direct proportion to the quantity that can be carried up it, in that time; which may be effected by duly proportioning the sizes of the apertures or perforations, or by the adoption of regulating stop-cocks; and in other modes of applying it, I cause the air, after it has passed through the *down-cast* pipe, to be distributed and dispersed under a large surface of water in a confined chamber, or reservoir, that it may take up a portion of the water by adhesion, in the same way that water is taken up in the formation of steam,—excepting that, in the one case, the water is taken up by the air; in the other, by caloric.

The air and the water commingled with it, or that quantity which is thus taken up by it *in the state of vapour*, is then allowed to accumulate above the surface of the *solid* body of water confined within such chamber or reservoir (assimilating in its object to a boiler for the generation of steam), until it attains the same pressure, per square inch, as the air flowing down the down-cast pipe. After which, it is allowed to flow through a pipe, extending above the surface of the liquid in such chamber, into the lower part of the pipe, where it meets with, disperses into drops, and carries up a still further quantity, in the manner herein-before described.

The weight of water in the pipe, *b b*, at any one time, must be less than the pressure given out by the ascending current of air.

At the top of the up-cast pipe, *b b*, I cause the air and water taken up by it, to be received into a dome, or other appropriate chamber, that the greatest portion of the water may be collected together again in a body, and thence be allowed to flow freely away. The air, and that portion of the water still retained by it, is also allowed to escape.

In other modes of raising water by my improvements, as aforesaid, I produce and maintain, by any of the mechanical means adapted to the end, a partial vacuum in the pipe, *b b*; and instead of employing a *down-cast* pipe, *a a*, to convey condensed air into the pipe, *b b*, I allow air to flow into it from the mine, through pipes arranged for that purpose; so that, by the difference of pressure between the air in the mine, and that in the pipe, *b b*, the water may be carried up by an ascending current of air.

Another important feature of this invention is, that the ventilation of a mine may be carried on free of charge. For the fan or fanner, or blowing cylinder, may be made to receive its air from the open atmosphere; or, by means of pipes extending to the required distance, the air may be received from the depths of the mine; or without employing pipes, it may be received from the upper part of the *up-cast* shaft of a mine, which must be domed over for that purpose. By which mode of operation, the impure air of a mine may be withdrawn, that pure atmospheric air may descend the shaft or pit, by its gravity, to occupy its place.

Having thus described the nature of the invention, and the manner in which the same may be performed and carried into effect, I wish it to be understood, that the velocities of the air, as due to given pressures, and the descending velocities of drops of rain, when falling through the atmosphere, are given by me as approximative numbers only: for atmospheric changes, and other causes, will produce a material variation from them. And I wish it to be further understood, that I do not, in this patent, confine myself to the precise arrangements and dispositions of the combinations and contrivances herein described, and shown by the engraving; but I avail myself of all such other combinations and contrivances as in mechanics are equivalent thereto.

ADDENDA.

By some persons it is supposed, that air cannot be made to flow through pipes of great length.—This supposition has been produced by a statement made in Dr. Robison's "*Natural Philosophy*," art. "*Pneumatics*," respecting an experiment conducted, many years ago, at an iron-foundry in Wales.—It is there stated, that an engineer erected a machine, at a powerful fall of water, to work a pair of blowing-cylinders, or cylinder-bellows, the blow-pipe of which was conducted to the distance of a mile and a half, where the delivery-pipe, or *tuyere*, was applied to a blast-furnace in the usual manner. But notwithstanding that every precaution was used, in making the pipes as smooth as possible, the experiment failed; and the failure was ascribed to the impossibility of making the pipes air-tight.—Other persons, since then, have ascribed the failure, with much better judgment, to the friction of the air against the sides of the pipe; but, being unacquainted with the laws which regulate the passage of fluids, have thence fallen into the erroneous opinion, that air cannot be made to flow through pipes of great length.

I am not acquainted with the sizes of the pipes employed by the engineer in Wales; but it is certain that he was wholly ignorant of the subject, and that the pipes were not properly proportioned to the length. His ignorance is shown by the following:—1, by his making the pipes as smooth as possible in the bore; 2, by his expecting to get the same pressure of air from a pipe a mile and a half in length, as from a short pipe; and 3, from ten minutes of time elapsing after the action of the piston in the blowing-cylinder had taken place, before the least wind could be felt at the end of the pipe, whereas he had calculated that the interval would not exceed six minutes.

With the view to elucidate these errors, and consequently to expose the ignorance of the engineer, I shall adduce the following:—

1. It is well known to those who are acquainted with the flowing properties of air, that providing there be no sudden enlargements and contractions in the pipes, it is a matter of comparative indifference whether the pipes be smooth in the bore, or left in the rough as when cast. For the delivery under the same length of pipe, under the same pressure, whatever that length may be, is, as nearly as possible, the same in both cases.

2. That the greater the length of pipe, the greater, under certain definite proportions, must be its diameter, in order to overcome the friction, and to deliver, under the same amount of pressure in the blowing-cylinder, a given quantity of air in a given time. Hence, as the diameter, and consequently the area of the pipe *increases*, the pressure of the air must *decrease* in a correspondent proportion.

3. That atmospheric air, however compressed, and therefore under whatever pressure it may act, cannot, practically, flow with the rate of speed assigned by him, that is, 1320 feet in a second, *even into a vacuum*; much less through pipes a mile and a half in length, and under the moderate amount of pressure, which is three pounds per square inch, used, commonly, in blast-furnaces.

To illustrate this still further, and to show how easy it is for persons unacquainted with these subjects to fall into error, and thence to deduce erroneous conclusions, I will suppose that 3000 cubic feet of air per minute, at three pounds pressure per square inch beyond the atmosphere, had to be driven into a blast-furnace; and that the engineer, in Wales, finding that a pipe 4½ inches diameter, when only from a foot to a foot and a half in length, would deliver that quantity, had put down a pipe of twice that area, or 6 inches and four-tenths in diameter.

The quantity of air, per minute, that would have been discharged through that pipe, when of different lengths, and under the same amount of pressure in the blowing-cylinder, would have been as follows:—

Length of Pipe.	*Discharge per minute.*
100 feet	3000 cubic feet.
200 „	2230 „
300 „	1870 „
400 „	1640 „
500 „	1470 „
1000 „	1060 „
½ mile	660 „
1	480 „
1½	380 „

e, we find that, by improperly proportioning the diameter of the
to the length, instead of discharging 3000 cubic feet of air per
te, at the distance of a mile and a half, it would have discharged
380 cubic feet. In fact, that the diameter of the pipe would
been adapted, only, to 100 feet in length.

have discharged the 3000 cubic feet of air per minute, the
eter of the pipe for each length, and under the same pressure in
lowing cylinder, would have been as follows:—

Length of Pipe.	*Diameters.*
100 feet	6·4 inches.
200 „	7·2 „
300 „	7·8 „
400 „	8·2 „
500 „	8·5 „
1000 „	9·8 „
½ mile	12·0 „
1 „	13·5 „
1½ „	14·7 „

these diameters, and under any one of the lengths thus given,
000 cubic feet of air, per minute, would have been delivered.
of course, at the end of the pipe, the furthest from the power,
ressure of the air would have been proportionably diminished, or
y so. This diminution of the pressure of the air, in the *up-*
pipe, in applying the patented modes of raising water from mines
eat depth, is an advantage rather than a disadvantage; it gradu-
educes the speed of the ascending current, and allows the water,
delivered at the top of the mine, the more freely to be collected
her again in a body, that it may thence flow freely away.

e *down-cast* pipe may be so proportioned as to maintain nearly
ual pressure throughout its length.

Henry Adcock,
Civil Engineer.

e of Mr. Adcock's patent apparatus is now being put down at the
erton Colliery, Wigan.

CANDIDUS'S NOTE-BOOK.

FASCICULUS XVIII.

"I must have liberty
Withal, as large a charter as the winds,
To blow on whom I please."

Notwithstanding the flunky sort of admiration professed to be
tained by many for Sir John Soane, no one, it seems, cares to imitate
I do not say in his peculiar style—or rather, fantastic mannerism,
those matters wherein he has set a really good precedent. It
e he is an exceedingly bad authority to follow because his archi-
ral merits and vices are invariably so mixed up together that it
res some study to disentangle them. While the outside of his
in Lincoln's Inn Fields exhibits the most paltry and puerile
and has a most offensive gim-crack and gin-palace physiognomy,
terior offers much that deserves to be adopted: not that it is by
eans particularly good in itself, but on account of the hints and
as to contrivances and effects, which it affords, and the sugges-
it holds out. While there is much in it that is exceedingly poor
en paltry,—what no one would think of copying, or rather would
some pains to avoid, there are several things which might fre-
tly be imitated, and applied in a variety of ways, and in many
with little trouble or expense. For instance, the very same
ivance which is adopted in the Picture Cabinet, is susceptible of
modifications, some of which might be conveniently applied to
ns, bookcases, and similar pieces of furniture, without fitting-up
hole of a room in that manner.

I find that Bartholomew is exceeding angry with me, pouring
he vials of his wrath upon my head, asserting that Caninus would
more suitable name for me, and among other compliments insinuating that I am descended from Gehazi the servant of Elisha—which is certainly tracing back my genealogy further back than that of any one now living. But what if after all if my real name should turn out to be White, and that I have taken the liberty of latinizing it; instead of arrogating to myself by my assumed appellation any particular stock of Candour? Any one who is not absolutely as blink-eyed as B. might instantly have perceived from the very motto I have chosen that I disclaim all pretensions to greater candour than my neighbours. Besides there are two different sorts of candour;—one of which consists in *ingenuously* confessing our own faults, the other, in *ingeniously* exposing those of our friends; which last is that possessed by me. After all, whether I am candid and indulgent, or quite the reverse, has nothing to do with the matter: what chiefly concerns my readers is whether my opinions are well founded and deserving of consideration. Even Bartholomew himself does not pretend to say the contrary—at least he has not cared to call any one of them in question, by pointing out its absurdity and fallacy. His compliments apart, the worst it would seem, that he can find to say of me is that I am given to barking—which is no more than I myself confess in the very passage he has quoted,—and that I like to have all the "cutting" to myself. Granting this last allegation to be well founded, though I am not conscious of having uttered any thing that can be construed as a desire to monopolize that operation;—granting this, I say, it would follow that there exists a perfect harmony of tastes between myself and Bartholomew, for he is not at all sparing of cuts at his professional brethren; and he not only barks, but growls too, most doggedly. This man who makes such a pleasant outcry against cutting and maiming, makes no scruple of stabbing poor John Nash's reputation, asserting that he was not gifted with one of the accomplishments "so necessary to an architect." Nay he may be said to massacre reputations by wholesale, damning, as he does, in the lump, both the taste and practice of professional men at the present day;—for which he may perchance one day or other be sainted by them, that is converted into a *St.* Bartholomew, by being flayed alive.—Most surely when he calls Holland, who died in 1806, one of the last of England's *real* architects, it is tantamount to a sweeping condemnation of all the members of the profession at the present day. Nevertheless poor little Bartholomew affects to be shocked at me;—which is undoubtedly highly amusing.

III. There is, I admit, one very great point of difference between us, for as he belongs to the profession himself, Bartholomew may probably feel that he has a right to abuse it as much as he pleases, without any body's interfering to hinder him; whereas I being no more than one of those whom he denounces as self-made critics, cannot reasonably look to enjoy a similar privilege. With all due deference, however to Saint Bartholomew, I conceive that all critics are and ever have been self-made or self-constituted: at least I never heard of their taking their degrees as such at any college; or of their being appointed to that capacity by Her Majesty; or of critics being made by Act of Parliament. Critics, I should fancy, are one and all volunteers in the service they engage in,—and of course myself among the rest. The day will perhaps arrive, when matters will be managed far differently, and we critics be elected in the same manner as members of the House of Commons. In the meanwhile the Gwilts and the Bartholomews must submit whether they will or no to our present self-election. One comfort for them is that they are not obliged to read our impertinences, or to waste their precious time in refuting what they would persuade others is only arrant ignorance. It certainly is extraordinary that architects—and architects alone, should show a disposition to gag criticism and stifle discussion, or even the expression of opinion. Notwithstanding which the generality of them, I believe, have no particular aversion even to ignoramusses giving their opinion to the world, when it happens to be complimentary to themselves, and of course, most sensible, and most orthodox.

IV. Whether Mr. Wightwick will be considered altogether orthodox by Bartholomew, is to me a matter of very great doubt, or rather no doubt at all; the avowed object of the author of the "Palace of Architecture," being to popularize the study of the art, to divest it of all that mystery and humbug which have so long rendered it an arcanum,—an art which the public are no less funnily than modestly called upon to admire with all possible admiration, and assured in the very same breath that they can neither comprehend nor properly relish it! With what unspeakable horror must such gentlemen as Gwilt and Bartholomew read the following sentence in Wightwick's book: "and now we would finally address a concluding question to our fair COUNTRYWOMEN. Can they do better than give some of their leisure to an art so essentially decorative as that of architecture?" This is liberality with a vengeance! Is there no salic law to prevent this threatened female tyranny over architecture? Why in another generation we shall have a swarm of Candidi or rather Candidæ in petticoats! By the shades of Vitruvius and Palladio, Wightwick's doctrine is most

Pestiferous! and devoutly is it to be hoped that he will receive an exemplary good thrashing from St. Bartholomew the Little.

V. Upon one point, indeed, Bartholomew and Wightwick, though in all other respects almost antipodal, agree tolerably well; namely in their estimate of the Elizabethan style, against which they both formally utter their protest,—Wightwick briefly yet energetically, and Bartholomew at considerable length, cataloguing its vices and deformities one by one. So far, however, from attempting there to contradict him, I am more inclined to say *ditto* to his strictures; and if nothing else, they certainly do show some boldness in venturing to run quite counter to the taste of the day, for that barbarous fashion has been taken all of a sudden most wonderfully into favour, and has in consequence had several ably executed and expensive works, by Joseph Nash, Richardson, &c., especially devoted to it; which productions are not calculated to allay the feverish admiration of the public.

VI. "Elizabethan carving," says my worthy friend Bartholomew, "resembles the schoolboy's performance with a penknife upon sticks of firewood, some degrees below the workmanship of Dutch toys"!! This is tolerably strong—nay, shows that the tender and merciful B. is quite as well entitled to the epithet *Caninus* as myself, and no less fond of cutting up, what he does not like,—which I take to be in general the case with all of us—both saints and sinners.—Let us proceed: "some persons," he afterwards observes, "very highly praise the Elizabethan buildings, solely on account of their general effect; but they never can defend any of their licentious and childish details, which indeed may at once be said to contain all the *faults and corruptions of design and composition which have ever been condemned in every style of architecture, by every description of critics, of every age, and of every country in the world*"!!! Now for one who dislikes "barking," this is valiantly vituperative.

VII. Our amiable St. Bartholomew verifies the adage of *Clodius accusat mœchos*, for though he professes to be quite scandalized at my naughtiness, he, as has already been shown, leaves it to be inferred plainly enough that the race of "*real architects*" is now altogether extinct among the profession; and even talks of "*the sneaking, fraudulent, pickpocket system which has led to extensive Fauntleroyism in modern architecture*"!!!

— Bartholomew, my boy! we are now quits: you are a d— honest, plain-speaking, though somewhat hard-mouthed fellow,—one who does not mince matters at all. I would advise you, however, to have a little more fellow feeling, and not serve me as the pot does the kettle; nor be quite so unmindful of your own dear self as to imagine me the only canine candid creature in this naughty world who has a taste "for abusing every body, and every thing," when you are pleased to libel the whole professiou at one fell swoop, and to represent modern architecture as little better than a system of fraudulent knavery coupled with the most disgraceful ignorance.

PUBLIC BUILDINGS IN LONDON.

A Critical Review of the Public Buildings, Statues and Ornaments in and about London and Westminster—1734.

BY RALPH.

(Continued from page 264.)

I suppose my readers have already observed, that during the course of my essays on this subject, I have not contented myself with bare remarks on the ornaments I find finished to my hand; but that I have taken all opportunities, beside, of pointing out ways and means which either may, or might have been made use of to refine upon some, to adjoin others, and make the most of every situation for the beautifying and adorning the whole.

It is in this view I often mention things, which by the interfering of property can never take place: and hold myself excused, in the presumption that a neglect in one particular, may be made a spur to the improvement of another.

The new church (St. John's), with the four towers, at Westminster, is situated in such a manner, with respect to Old Palace Yard, that it might have been seen from thence, at the end of a noble vista, to the greatest advantage imaginable: the sight of the towers over the tops of the houses, put every body in mind of this, and it is with much regret that we lose such a beauty.

As to the building itself, it is in a very particular taste, and has a great mixture of beauty and caprice in it: there are many parts of it which I approve, and many more which I condemn: it is to be sure a fatal mistake, to endeavour at an excellence, and than err so wide of the mark as to stumble on deformity; all false ornaments become faults instantly, and only serve to make an absurdity more conspicuous. If the architect of this pile had once thought of this rule, I am persuaded he would have been abundantly more chaste in his compositions, and cut his towers, like that of Babel, off in the middle.

Henry the Seventh's chapel has an undoubted right to be taken notice of in a very particular manner, as being one of the most expensive remains of the ancient English taste and magnificence: to be sure there is no looking on it without admiration; but then its beauty consists much more eminently in the workmanship than the contrivance; which is just the reverse of what it ought to be.

The proportion and harmony of a plan is the first grand secret in building; nicety, and point in execution the last: thus it happens that the edifice before us has nothing in its form to surprise or charm; and all the expence of art, which is lavished away upon it, only excites pity that the subject deserved it no better.

I am very sensible I run no small risk of being censured for making so free with so celebrated a pile as this: but as I profess myself clear of all prejudice, and only in pursuit of truth, so I shall take all the liberties which are of a piece with such a character, and resolve to be governed by reason and judgment only.

On these principles, therefore, I will boldly affirm, that nothing could be more absurd than erecting this fabric at the end of the Abbey; it now serving only to spoil the symmetry of both, and make a botch instead of adding a beauty: if there were any point of view where both these pieces might be seen together, the truth of my assertion would be apparent, and as it is, a little imagination will answer the same end.

Let us farther add that, by this unnatural conjunction, the whole magnificence of front, which might have been given to this costly chapel, is entirely lost, and those who admire it most implicitly and devoutly, cannot help enquiring for an entrance suitable to the rest of the structure.

Let us for once then suppose, that it had been entirely detached from the Abbey, and erected opposite to the House of Lords, with a sumptuous front to the street; let us suppose the new Parliament House finished on the other side, and the before-mentioned vista laid open to the new church, and the consequence would then be another group of beauties in building and decoration, which few cities in Europe could parallel.

By the many things I have said of the advantage of space before a building, in order to add magnificence to the view, no body will wonder, I presume, that I am for levelling the Gate-house, demolishing a large part of Dean-yard, and laying open the street at the west end of the Abbey, at least, to an equal breadth with the building. I must frankly own nothing appears so miserable to me, as such incumbrances round a grand or elegant building: they abate the pleasure of the prospect most exceedingly, and are real disadvantages to the builder's fame.

Westminster Abbey is a fabric of great antiquity, and challenges some kind of veneration on that account: it is besides of prodigious bulk, and fills the eye, at least, if it does not satisfy it: to glance at it in the landscape, without examining its parts, it pleases tolerably well; to examine its parts, we are under a necessity of disliking the whole: if the height surprizes, we are out of humour with its form; and the fronts in particular ought to have rose eminently above the rest, in order to have varied the lines, and given that grace it so visibly wants. We now rather think of a barn than a church; I believe this image is owing intirely to the extreme sharpness of the roof, and if that was rectified, it would be greatly to the advantage of the building in general. It must be owned indeed, that the west end was never finished, and there is much reason to believe that the two towers, on each side of it, were designed to give the elevation, it is now so apparently defective in.

There is indeed a rumour about the town, that the Dean and Chapter still design to perfect this scheme, and raise the towers according to their first projection: but I think it is rather too late to begin, for unless they would new-case the church all over, the mixture of the new and old would have a worse effect, than the defect we complain of, and make a sort of patch-work in building, which is ever offensive both to judgment and taste.

As to the inside of the church, it is certainly more perfect and judicious than the out: the perspective is strong and beautiful, and strikes the spectator in a very forcible manner, as soon as he makes his entrance; and yet it owes the greatest part of its effect to a fault in symmetry. It is the exceeding height of the grand isle which gives the astonishment; but if that was only in exact proportion to the res of the parts, it would not be distinguished so much, and yet would deserve much greater praise.

Some of my readers would perhaps take it ill, if in this place, and writing on the curiosities of the Abbey, I should not say something in honour of the fine wax-work figures which are placed so curiously up and down this venerable building; particularly the king William and queen Mary, which have been lately so amicably shut up together in the same box. To oblige them therefore, and in compliment to the reverend Dean and Chapter, who permit these noble decorations, I will throw away a moment or two in giving my opinion of them. In the first place, therefore, with all submission to better judgments, I think they are ridiculous and unnatural in themselves, expressing neither figure like statuary, nor colour like painting: secondly, I am humbly of opinion that they would become a puppet-show better than a church, as making a mere farce of what should be great and solemn: and, thirdly, I think them highly injurious to the characters they represent, as showing them like jointed babies, to the stupid admiration of the vulgar, and the contempt of men of sense; instead of characterizing their persons, and perpetuating their virtues.

For all which, and many more reasons, I beg leave to move that the whole present set of waxen worthies may be demolished without benefit of clergy, and that all their present patrons and abettors may be substituted in their place; and that, as fast as any future reverence should endeavour to seduce his brethren to the like idolatry, he should be immediately chronicled in wax, and shewn with a cap and bells, to distinguish the extent of his understanding, and the perfection of his taste.

The inclosure, behind the altar, commonly known by the name of St. Edward's chapel, has nothing remarkable in it but certain Gothic antiquities, which are made sacred by tradition only, and serve to excite a stupid admiration in the vulgar.

There is indeed, at the end of this place, a sort of gate to the tomb of Henry V. which was intended for a piece of magnificence, and no cost was spared to make it answer that design; but the taste of it is so unhappy, and the execution so wretched, that it has not the least claim to that character. The tomb of that prince challenges attention only because it was his, and because the statue on it has lost its head: to account for which singular injury, we are told a ridiculous tale of its being silver, and that the value of it occasioned the sacrilege.

One thing, it is true, we meet with in this place, which merits a peculiar regard; that is, a wooden chest of bones, said to be the remains of Catharine, daughter of the king of France, and consort of Henry V. If this account is authentic, I think nothing can be a greater violation of decency, or more injurious to the memory of such illustrious personages, than to expose their relics in so licentious a manner, and make a show of what once commanded respect and adoration. If the clergy are advocates for the decency of burial, as no doubt they are, because of the profits which attend it, why do not those, who have this church under their care, comply but with their common tenets, and grant this indulgence to the ruins of majesty? To be sure I can have no other answer but this, that they bury some for gain, and some they leave unburied for the same reason.

It is beyond controversy, that there is something extremely shocking in this violence to the secrets of mortality: the ancients had even a superstitious regard for the dust of their ancestors, and surely we are under some obligation to treat ours with good manners: and how the reverend Dean and Chapter can reconcile this principle with their conduct, I leave to the most learned casuist, among them, to determine. If they would hearken to my humble advice, they would not be so very intent on worldly interest, as to neglect worldly reputation: reputation is interest too, and such trespasses as these, in the eyes of men of delicacy and understanding, are not easily forgiven or forgot.

The arch at the entrance of Henry the Seventh's chapel, is exceeding grand and ornamental: the steps underneath are a fine preparation for the scene at landing, and the three doors an admirable expedient to favour the perspective within: but this, and several other beauties, are utterly spoiled by the stalls, which cut off the collateral isles of the chapel intirely, and thereby spoil the beauty and symmetry of the whole.

The roof of this structure is certainly one of the finest things in the world, I mean in the Gothic style: nothing can be in a better form, or more richly decorated: perhaps had it been more simple it had shown to greater advantage; but still it is a wonder that one continued cluster of ornament could be contrived to please so much, and answer so well.

Were the absurd partitions mentioned above thrown down, the roof would appear still more surprising, and the area before more spacious and proportionable: all those tombs which are now shut up in such a manner, that they are no where to be seen as they ought, would then come foreward to the eye, and give an additional grandeur and solemnity to the scene: the perspective would be finely broke, and every object properly terminate in the founder's mausoleum, as the principal point of the whole view.

There are few tombs in Europe more famous than that of Henry VII. neither indeed are there many which deserve to be more so. The undertaking, in itself, was vast and surprizing, the cost prodigious, and the execution exceedingly difficult and laborious. And yet the artist has succeeded in it to admiration; there is hardly a part in it that is not excellent, from the chief figures to the minutest point of the decoration: the statues of the king and queen are grand and noble, and the bas-relief on the sides below, beautiful and expressive. I am of opinion the workman, whoever he was, was equal to the noblest scheme of this nature, and would have made a figure even amongst the ancients. What a pity it is, therefore, that such a genius, and so much art should be lavished away on a thing entirely out of taste, and which, at the same expence and study, might have been made the wonder of the world! To explain myself farther on this head, nothing can be more stupid than the laying statues on their backs, in such a situation, that it is impossible they should ever be seen to advantage, and of course, that all their perfections must be utterly thrown away. In the next place, the brazen inclosure, which surrounds this tomb, wonderful as it may be, considered by itself, is a monstrous blemish, with regard to the thing it was intended to preserve and adorn; because it rises abundantly too high, and intercepts the view intirely from the principal objects.

Without doubt, the statues of the king and queen, ought to have been in living attitudes, erect, and bold, and the decorating figures should have formed a corresponding group, which in every light, should have stood the test of criticism, and given the spectator an intire satisfaction: a few more steps too should have been added to raise the foundation higher; a magnificent arch might have been thrown over all, and the boundary below should have been only a guide, not an incumbrance to the prospect.

Yet, erroneous as the taste of this fine monument may be, it may be called excellent to that which prevailed several years after in the reign of king James I. as may be seen by the wretched things, which were erected at his command, to the memory of queen Elizabeth, and his mother, Mary queen of Scotland: in these all the blunders that can be imagined, are collected together: want of attitude and expression, harmony and proportion, beauty and decoration: nay, the very columns, which support the superstructure, are of different sorts of marble, and, to make the figures splendid and natural, they are painted and dressed out to the life, as if they were just retired from a drawing-room, and laid down there for a little repose.

But these whims seem to be again out of repute in the reign of his son, as appears by the monuments of the Dukes of Richmond and Buckingham: in these there are several fine figures in brass, and something like meaning and design; though even then they had not learned to distinguish the principal characters, and place them in such attitudes, as should command the spectator's first and last attention and regard.

Both these faults are intirely avoided by Rysbrack, in the monument erected in the honour of the late Duke of Buckingham: there the Duke himself is the principal figure in the group, and though he is in a cumbent posture, and his lady, in the most beautiful manner, sitting at his feet, yet her figure is characterized in such a manner as only to be a guide to his, and both reflect back a beauty on each other. The decorations are exceedingly picturesque and elegant: the trophy at his head, the finger of Time above, with the medals of his children, fill up all the spaces with so great propriety, that as very little could be added, nothing can be spared. In a word, I have yet seen no ornament that has pleased me better, and very few so well.

I will conclude my remarks on the Abbey, with some brief reflections on the use of sepulchral monuments in general, which will, at once, serve to illustrate what has been said on the tombs already erected, and likewise be of some service to the statuary in designing those which may succeed hereafter.

However amiable fame may appear to the living, it is certainly no advantage to the dead: whatever dangers they have dared, whatever toils they have undergone, whatever difficulties they have surmounted, the grave is deaf to the voice of applause, and the dust of the noble and vulgar sleep in the same obscurity together. It is possible the conscious spirit may have an idea of the honours that are paid to his ashes; but it is much more probable, that the prospect of this imaginary glory, while he lived among us, was all the pleasure it ever could afford him. I make this observation, because most monuments are said to be erected as an honour to the dead, and the living are supposed to be the least concerned in them: whereas on the contrary, there are few but what were rather founded in compliment to the builder's vanity, than in respect to the name they are inscribed with. One man's fame is made the foundation of another's, who ordered this sentence to be made his epitaph; here lies Sir Philip Sidney's friend. Some there are that mention only the names of the persons whose dust they cover, and preserve a noble silence with regard to the hand who raised them; but even here, the dead can receive no benefit from such disinterested affection; but the living may profit much by so noble an example. Another thing that displeases me, is the manner of the inscriptions, which frequently mistake the very design of engraving them, and as frequently give the lie to themselves. To pore one's self blind in guessing out *Æternæ memoriæ sacrum* is a jest, that would make Heraclitus laugh; and yet most of them begin in that pompous taste, without the least reflection that brass and marble cannot preserve themselves from the tooth of time; and if mens' actions have not guarded their reputations, the proudest monument would flatter in vain.

I do not say these things because I am an enemy to the custom: so far from it, no one can admire it more; but what I intend is, to place every thing on its right principle, and recommend the properest means for the consequence. It is certain there is not a nobler amusement in the world, than a walk in Westminster Abbey, among the tombs of heroes, patriots, poets, and philosophers; you are surrounded with the shades of your great forefathers; you feel the influence of their venerable society, and grow fond of fame and virtue in the contemplation: it is the finest school of morality, and the most beautiful flatterer of the imagination in nature. I appeal to every man's mind that has any taste for what is sublime and noble, for a witness to the pleasure he experiences on this occasion; and I dare believe he will acknowledge, that there is no entertainment so various, or so instructive. For my own part, I have spent many an hour of pleasing melancholy in its venerable walks; and have been more delighted with the solemn conversation of the dead, than the most sprightly sallies of the living. I have examined the characters that were inscribed before me, and distinguished every particular virtue. The monuments of real fame, I have viewed with real respect; but the piles that wanted a character to excuse them, I considered as the monuments of folly. I have wandered with pleasure into the most gloomy recesses of this last resort of grandeur, to contemplate human life, and trace mankind through all the wilderness of their frailties and misfortunes, from their cradles to their grave. I have reflected on the shortness of our duration here, and that I was but one of the millions who had been employed in the same manner, in ruminating on the trophies of mortality before me; that I must moulder to dust in the same manner, and quit the scene to a new generation, without leaving the shadow of my existence behind me; that this huge fabric, this sacred repository of fame and grandeur, would only be the stage for the same performances; would receive new accessions of noble dust; would be adorned with other sepulchres of cost and magnificence; would be crowded with successive admirers; and at last, by the unavoidable decays of time, bury the whole collection of antiquities in general obscurity, and be the monument of its own ruin.

Yet in spite of these sage reflections, this plain prospect of general decay, I must own, it is a great pleasure to me to see a new statue added to the last; to see another name of glory increasing the catalogue: it is a taste I am particularly fond of, and what I congratulate the present age for encouraging so much. I am always one of the first to survey a new monument, to criticise on its beauties, and point out its defects. I have sometimes the pleasure of observing a beauty, and often a fault in our modern artists; and should be glad to take an occasion of applauding the first, and mending the last. I would have all works of ornament perfectly beautiful and elegant; or else they disappoint the very intent of their being. I would have all statuary, in a peculiar manner, excellent. A polite people are most distinguished as such, by their buildings, their statues, and their inscriptions; and I am sorry to say it, we are generally defective in all. There is one noble lord amongst us indeed, who has taken great pains, and been at vast expence, in improving our taste in one of these particulars; but I do not find so eminent an example has influenced many more to an emulation of what has done him so much honour. In a word, sepulchral monuments should be always considered as the last public tribute which is paid to virtue; as a proof of our regard for noble characters; and most particularly, as an excitement to others to emulate the great example. In a word, I cannot look upon that which is raised over the ashes of Sir Isaac Newton in any other light: his honours were all owing to his own merit; neither is it in the power of the finest statue, or the sublimest inscription, to afford him any addition. Had his remains rested without a name, like Milton, or Shakespere, or Shaftsbury, or Nassau, it would have been a new reproach to an ungrateful people, but no injury to him. On the other hand, the utmost magnificence of funeral honours would only be a credit to us, without doing him any service. Having lately observed that this stately mausoleum had made the entrance into the choir irregular; it was answered, that if we waited with an equal name among the moderns to make it uniform, it would hardly be so to eternity; and if an inferior was to be ranged with him, it would be a disadvantage to both. It is most certain, that there are few characters that approach any thing near to an equality, and the many vain trials that have been made for his epitaph, are the highest compliment to his desert: it is a proof that language was too weak to express it, and hyperbole itself too faint for the admiration that was due to his accomplishments.

THE NELSON MONUMENT AND TRAFALGAR SQUARE.

REPORT.

The Select Committee (of the House of Commons) appointed to inquire into the Plan sanctioned by the Commissioners of the Woods and Forests for laying out the vacant space in Trafalgar Square, in front of the National Gallery, and who were empowered to report their Observations, together with the Minutes of Evidence taken before them, to the House,—have considered the matters to them referred, and have agreed to the following Report.

YOUR Committee must begin by observing, that the nature of the projected works in Trafalgar Square not having come under their consideration till after those works were begun, they found themselves in a position less advantageous for the performance of the task which was placed in their hands, than had the field of inquiry been completely disembarrassed. They endeavoured, however, to free their minds from all extraneous circumstances, and only to consider what would most contribute to the embellishment of that part of the town.

They felt, that under the terms of their appointment, all that was to be done within the area of Trafalgar Square came within the limits of their inquiry, and that they should have ill discharged their duty to the House and to the public, had they not adverted to whatever works were designed for that situation; a situation which is indisputably one of the noblest in the metropolis; an area which has been obtained at a great cost, and the final decoration of which must have so large a share in determining the character of that conspicuous part of the capital.

Your Committee will begin with adverting to the plan for laying out the area itself. They find that, so long as 1837, a plan for laying out Trafalgar Square was submitted to and approved by the Lords of the Treasury; but, for reasons which do not appear, was never begun. In the course of April, 1840, the plans supplied by Mr. Barry, for the same object, were approved by the Woods and Forests, and are now in progress. The estimate for these works amounts to £11,000, independent of the pavement of the square, and of certain ornaments of bronze, which, in the judgment of Mr. Barry, are desirable. The chief features of Mr. Barry's plan are, the levelling of the area from front to back, and the construction of a terrace 15 feet high, on the south side of the street, in front of the National Gallery. The effect of this terrace will be greatly to improve the appearance of the National Gallery, by giving it the elevation, for the want of which it has been chiefly censured. Mr. Barry, on being questioned by your Committee, gave it as his opinion that the appearance of the National Gallery might be further improved, by continuing the order of pilasters through the whole length of the front, and relieving the baldness of the cupola, by encircling it with pillars, and giving it a bolder cornice; which additions, he is of opinion, the existing walls would be capable of supporting.

Your Committee having satisfied themselves that Mr. Barry's plan for laying out the ground in front of the National Gallery was, under all the circumstances of the case, well adapted to reconcile the various difficulties of the spot and attain the desired end, proceeded to inquire what effect the column which is about to be raised by the Nelson Committee in the centre of the south side of the square, would have upon the National Gallery; how far a column of such dimensions would be seen to advantage in such a position; and how far it would contribute to the embellishment of that part of the metropolis. In order to assist their judgment on this important point, they called before them several architects of acknowledged merit, and availed themselves of the opinions of eminent sculptors and men of taste. These gentlemen were allowed an interval of two or three days to consider the subject: at the end of which they all sent in their opinions in writing. In the opinions of these gentlemen, as might be expected in a matter of taste, there is not perfect unanimity; but your Committee feel to have derived great advantage from having consulted them, and by carefully weighing their opinions and examining the principles upon which these opinions are based, have arrived at conclusions of their own.

Your Committee are of opinion that such a column so situated would have an injurious effect upon the National Gallery, by depressing its apparent altitude, and interrupting that point of view which should be least interfered with.

They are of opinion that a column of such dimensions will render the surrounding buildings less important, and, so situated, will not group well with anything in its neighbourhood.

They are of opinion that, as approached from Whitehall, as seen at the termination of this grand avenue, which forms one of the principal entrances of the metropolis, the appearance of the National Gallery will be much injured by the column. In this point of view the column will cut the National Gallery through the centre, and the pedestal of the column alone will nearly conceal both the portico and the cupola.

They are of opinion that the site selected is not a favourable position for the column itself.

There is another point to which your Committee will advert, which is, that the statue of King Charles is not in a line with the column; nor could this defect, from the proximity of the two objects, fail to catch the eye. So long as there is no column in the proposed situation, the statue of King Charles, where it now stands, is a fortunate circumstance, offering a subordinate object in front of the National Gallery, which serves as a scale, without obstructing the view.

Your Committee, entertaining these opinions, are unable to avoid arriving at the conclusion, that it is undesirable that the Nelson Column should be placed in the situation which is at present selected. If it is desirable in a great city to suggest the idea of space, and having once obtained space, not to block it up again—if the general architectural effect of Trafalgar Square, or of the buildings around it, is to be at all considered—or if, at any time, an equally conspicuous position should be desired for any other monument—the situation at present selected for the Nelson Monument is most unfortunate.

Your Committee having arrived at this decision, proceeded to inquire at what cost a change of plan in the position of Nelson's Column could now be effected, and how far it would be consistent with good faith now to interdict the Nelson Committee from prosecuting their work in the situation in which it is commenced.

What has actually been done towards the erection of the Nelson Column is no more than the excavation for the foundation, and pouring in the concrete which is to form a bed for the masonry, the expense of which, in Mr. Barry's opinion, would be more than covered by 1,000*l.* Contracts, however, have been entered into by the Nelson Committee, a failure to complete which would subject them to actions at law. It is not, however, probable that, if the same work were entrusted to the same persons in another situation, such actions would be instituted. The pecuniary loss, therefore, would not of itself entail so great a sacrifice as to preclude the idea of even now adopting a preferable course.

"But it appears by the Treasury Letter, bearing date 27 January, 1840, that the Lords of the Treasury have authorized the Commissioners of the Woods and Forests to deliver over the site appropriated for the Nelson Monument to the Committee for carrying that object into effect; and according to the evidence of Mr. Scott, it appears that the Architect has taken possession of the site, and has commenced the concrete and brickwork of the foundation, in which considerable progress has been made, and on the completion of which the Nelson Committee are bound to pay the contractors the sum of 2,000*l.*"

Your Committee cannot doubt that the Lords of the Treasury in authorizing the Commissioners of Woods and Forests to give that site to the Nelson Committee for the erection of the proposed column, entertained the fullest confidence that funds would be provided for carrying out the work in conformity to the plans and drawings which had been seen and approved; and they feel they should be wanting in their duty if they failed to direct the attention of the House to the fact that, according to the evidence, the subscription is at present deficient for the purpose, to the amount of some thousand pounds. Mr. Railton informed the Committee that his estimate of the column amounts to £28,000, whilst the sum subscribed does not exceed £18,000, nor does it appear that any well-grounded hope exists of any considerable addition.

It is true that contractors have engaged to complete the pedestal and the column for £15,000, and the metal for the capital is expected to be supplied by the Ordnance. But your Committee submit that a perishable statue of Portland stone is most objectionable; and supposing the terms of the contracts to be fulfilled to the letter (which in works of such a magnitude is seldom the case), the remaining £3,000 is wholly inadequate to meet the expense of casting the capital, of obtaining such a statue as ought to crown the summit, and of providing the bronze bas-reliefs for the sides of the pedestal, and the lions at the corners of the base. Even if the fund should prove sufficient to complete the masonry, no statue can be raised but one of Portland stone, and the column without its bas-reliefs will remain a denuded mass, which, however gigantic, will have a mean effect.

[The following is an analysis of the examination of the Witnesses.]

William Railton, Esq., was examined, he stated that he was an architect—that his plan was selected for the Nelson column. The height of the column altogether is now 170 feet, including the steps and everything; the original height was 203 feet; it was reduced about two months after the last competition, by order of the government. In consequence of a representation which was made to the Government, that the height of the column, exceeding that of any other column of the Corinthian order, which had ever been executed, would expose the column itself in that position to risk; the Government thereupon referred the consideration of the possible danger, and the character of its capital, to Sir Robert Smirke and Mr. Walker, the President of the Institution of Civil Engineers.—It was reduced altogether 33 feet in height, both from the shaft and the pedestal. So as again to put the whole building of the column into just architectural proportions, the other proportions were diminished altogether; the height of the shaft is 98 feet six inches; the pedestal of the statue 12 feet six inches; the statue 16 feet; the steps seven feet, and the pedestal 36 feet six inches high. The breadth of the square part of the pedestal is 17 feet. The amount of his estimate was £30,000. It will be done for less than that. He did not consider the reduction made any difference, as granite is to be used instead of freestone, which is of course very much dearer; the alteration has been no pecuniary benefit, though it may increase the durability, granite being stronger than freestone. From the use of granite instead of freestone it mounted up to 28,000*l.*; if it had been in freestone it might have been 203 feet high for the same amount; in granite it would, of course, have been more expensive at the 203 feet; it is to be completed in two years. He did not think the alteration in the position renders any other alteration necessary. As far as it intercepts the view of the National Gallery, the present position of the column is a great improvement. Where it was before, it was no detriment to the National Gallery; the Gallery is a very long line, and requires to be broken; therefore it brings it more into keeping. The position of the column is now settled to suit Mr. Barry's plan. The original site of the column was nearer the National Gallery than is now proposed. He considered that the position Government has selected for the column is as advantageous for its effect, and the general architectural effect of the whole site, as the position originally selected. He would have selected it himself, but at that time the ground did not belong to Government. They have obtained it since. He is better satisfied with it, as it is at present; it is certainly an improvement to the whole square; and it is seen better from the Strand and Cockspur-street, and from different places than it was before. He considered that a column was best calculated for this, He had well considered many other designs, and came to the conclusion that a column was best suited to this site, as it obstructs the view of the Gallery and all the buildings in the square less than others possibly can do, and by putting it in the centre, you have a better view of the National Gallery from every point than by putting it in a different situation; he did not think any other species of monument would so little interrupt the view of the National Gallery. The height to the top of the dome of the National Gallery is about 120 or 130 feet. The height of the spire of St. Martin's Church is 180 feet from the ground; to which must be added 12 feet six inches for the difference in the level, making 192 feet six inches; so that St. Martin's Church is considerably higher, and nearer the National Gallery than my column; and if that does not injure it, he did not see how his column could. Allowing for the difference in the elevation of the two, the difference in the height of St. Martin's Church is 22 feet six inches above the National Gallery.

Charles Barry, Esq., was examined, he stated that he was employed in laying out the ground in front of the National Gallery. He explained to the Committee the nature of his design for laying out the square. The area is proposed to be level; on the north side, in front of the National Gallery, a terrace is proposed 165 feet long and 32 feet wide, with a flight of steps at each end to the area below the same width (each step being two feet wide and five inches high), with ample landings in the circular corners of the square. The terrace is proposed to have at each end two large oblong pedestals for groups of sculpture, and circular pedestals for candelabra are proposed to be placed at the foot of each of the flights of steps, as well as at the angles of the square towards Cockspur-street and the Strand. The terrace and flanking walls of the steps are proposed to be surmounted by a balustrade. The terrace wall and balustrade will be 14 feet in height. The embankment or retaining walls to the surrounding streets are proposed to be surmounted by a solid parapet three feet high. The front or south side of the square, and the north side of the terrace towards the road in front of the National Gallery, are proposed to be enclosed by ornamental stone posts, so placed as to be a barrier against carriages and horses. The area is propossd to be covered with asphaltum. The terrace to be paved; and the whole of the masonry in the terrace and retaining walls, the steps and landings, the pedestals, balustrades, and lateral parapets, as well as the posts on the south side of the square and on the terrace, are proposed to be wholly of Aberdeen granite. The enclosed area from east to west is about 350 feet; from north to south, including the terrace on the north side which is 32 feet wide, is 290 feet. The area between the building from east to west is about 500 feet wide, and from the statue at Charing-cross to the front of the portico of the National Gallery, the length is about 470 feet. From the proposed column to the front of the National Gallery the length is 300 feet. From the column to Craig's-court, the length is 400 feet. From the column to Whitehall chapel, the length is 1,180 feet. From the column to the angles of Cockspur-street and the Strand, the length is 240 feet. From the column to the north-west angle of Northumberland House, the length is 180 feet; that is, as regards the dimensions of the square and the distance. The measurements are from the shaft of the column. The levels of the square below the road in front of the Gallery are as follows: at the base of the proposed terrace wall, 11 feet; at the proposed column, 11 feet; at Craig's-court, 25 feet; at Whitehall chapel, about 30 feet. The amount of his estimate is 11,000*l.*; the groups of sculpture and candelabra surmounting the pedestals should be of bronze. The asphaltum covering of the square, the pavement of the terrace, and the groups of sculpture on the pedestals, form no part of the estimate. He stated to the Committee the effect of the proposed column upon the National Gallery, when viewed from Craig's-court and Whitehall. When viewed from

Craig's-court, the stylobate will conceal the entire centre, extending to the columns in front of the gateways in breadth, and nearly the whole height of the podium; the bottom step of the pedestal will conceal rather more than the full width of the portico in breadth, and up to two feet from the bottom of the column in height; the top step will conceal rather less than the width of the portico in breadth, and up to eight feet from the bottom of the columns in height: the die of the pedestal will conceal one half of the portico in breadth, and up to within three feet of the springing of the dome in height. When viewed from Whitehall Chapel, the stylobate will conceal the whole of the portico and the projections on each side in breadth, and one half of the podium in height; the bottom step will conceal three-fourths of the portico in breadth, and five-sixths of the podium in height; the top step will conceal five-eighths of the portico in breadth, and up to two feet from the bottom of the columns in height; the die of the pedestal will conceal one-third of the portico in breadth, and to the top of the order in height; the shaft will conceal one-fourth of the portico in breadth, and the whole height of the building.—Mr. Barry gave it as his opinion that the area of Trafalgar-square was too small and confined for a column of the height and magnitude proposed: the effect of it would be to reduce the apparent size of the square, and render the surrounding buildings insignificant. The National Gallery, being small in its parts, and low in elevation, will suffer materially in this respect, more especially when viewed from Whitehall and Charing-cross, where the pedestal steps and stylobate, forming the base of the proposed column, will conceal a considerable portion of the portico, which is the most effective part of the building. The irregularity in the form of the area, the variation in the levels of the surrounding streets, and the direction of the several lines of approach, are not calculated to afford a favourable view of the column, except from Charing-cross and Whitehall, where, as he has before stated, it will have an injurious effect upon the National Gallery, whilst the Gallery will form an unfavourable background for the column. From all other points of view, the unsymmetrical position of the column, in respect of the surrounding objects, will be striking and unsatisfactory. The views of the proposed column from the ends of Duncannon-street and Pall Mall East, as well as from the road in front of the Gallery, would be unfavourable, in consequence of the points of sight being from 11 to 14 feet above the base of the stylobate on which the column rests. For these reasons, he was of opinion that the column will be improperly placed in Trafalgar-square.—In the event of the removal of the column, he should not wish to make any change in the general principles of it; it would in his opinion be desirable that the area should be left wholly free from all insulated objects of art, which in consequence of the irregular form of the square, and its level with reference to the higher and variable levels of the streets which surround it on three sides, would be unfavourably seen from many points of view. The four pedestals at the top of the flights of steps from the terrace might be surmounted by groups of sculpture, say of a man and horse, exhibiting the characteristic varieties of the human and brute form of each quarter of the globe; in the centre of the terrace-wall might be a fountain, composed of sea-horses, naiads, and tritons, surmounted by a semi-colossal figure of Neptune, which for the sake of the composition, and obtaining an effective view of it both from the square and the terrace, might be placed above the level of the balustrade. The four circular pedestals, two of which are proposed to be placed at the foot of the flight of steps from the terrace, and the others at the angles of the square towards Cockspur-street and the Strand, might be surmounted by candelabra, supported by groups of figures, and containing each a Bude or Drummond light, from which the entire square should be illumined by night. Thus, an opportunity would be afforded of giving scope and encouragement to sculptural art of a high class, and of giving that distinctive and artistic character to the square, which is so much needed in the public areas and squares of London, to excite amongst all classes that respect and admiration for art, so essentially necessary to the formation of a pure and well-grounded national taste.—In answer to a question put to him by the Committee, if he could suggest any other place for the Nelson monument? Mr. Barry stated that the centre of St. James's-square, if a central street were made into it from Pall Mall, would perhaps be eligible, or the Crescent at the top of Portland-place, or such a situation as the Circus between Oxford-street and Regent-street; or out of London, perhaps the best and most appropriate site would be in conjunction with Greenwich-hospital.—Mr. Barry gave the dimensions of the streets which would be left on either side of the area. Seventy-five feet would be the average width on the east side. The thoroughfare on the side of the Union Club and Morley's Hotel will be nearly the same as on the north, opposite the Gallery. On the north side in front of the National Gallery the width will be about 80 feet, which is the width, not of the pavement, but of the thoroughfare for carriages; the width of the street in the three cases as regards the thoroughfare for carriages, exclusive of the foot pavement, 50 feet in front of the National Gallery; 52 feet is the average width of the road on the east side of the square, and the width of the road for carriages on the west side is 40 feet. —There is a difference of several feet in the level of the general range of the ground line of the National Gallery, of three or four feet at least; the ground is highest near St. Martin's Church. It rather falls towards Pall Mall East. He had attended to the extreme difference of those two levels, and met that difficulty by lowering the end of Duncannon-street, and raising the street at Pall Mall East, and making a variable hanging level in the road in front of the National Gallery. By accommodating the fall of the road in the front of the National Gallery to the terrace, he makes it more in one place than the other, so as not to create an unpleasant effect to the eye; the balustrade is perfectly level, parallel to the foot of the National Gallery, and on the same plane. The plan has been sanctioned by Government, and the estimate is before Parliament for its completion as to the terrace. He had no doubt that by the introduction of the terrace, the effect of the National Gallery, as a building, would be improved. His object is to give an increased apparent height to the Gallery. He had no doubt that the erection of so high a column would have the effect of making more prominent the defects of the National Gallery. He was of opinion that the appearance of the National Gallery might be further improved; he explained to the Committee in what way it might be done. He considered that a continuation of the order of columns or pilasters through the whole length of the front would be one means of improvement, and by raising the dome and altering the design of it, would be another means of improving it. He was not prepared to say that the existing walls were strong enough; he had very little doubt they would, for the walls that carry the present mass would probably carry much more.—The cupola could be encircled with pillars; he would recommend a bolder cornice, and an increased height of the parapet, so as to conceal the lanterns which now just appear; he thought the walls probably would bear that. He was not prepared to state the cost of such an alteration. He had not considered the effect of removing the columns. He could not say that the proposed alterations would have the effect of completely curing the existing defects of the National Gallery. The great defect is its lowness; this would in part be obviated by raising the centre, and giving more elevation to the dome, but it would not make the entire mass appear high enough for effect. The original defect would in part be remedied, but it would still be there. He could not then form a rough estimate of the cost of executing some such plan as that, and of pulling down the materials and rebuilding it; the difference would be considerable; it would be cheaper.—The defects such as they are, of the National Gallery, as it now is, or even if the National Gallery is altered, would be more prominently brought forth by the erection of a column of that altitude in its front. In either case it would operate disadvantageously to the building. He did not consider that it would be worth while to do anything for the improvement of the National Gallery, if the column is to be placed in front of it.—In answer to the following question, do you think if it were thought desirable a trophy to Wellington and to Nelson should be erected in that area, that they could be so contrived as to contribute to the embellishment of that whole scene?—"Mr. Barry said, I think they could be so contrived, but I do not think it would be desirable. I think the area is not large enough for two monuments of a proper size for effect. And there is this objection, that the levels of the surrounding streets being higher than the level of the square, you would look at any monuments placed on the level of the square to a disadvantage." "Not if they were erected in bronze, would you?"—"It would depend on the nature of the monument; it might be lifted up by a rough basement; but I would rather that the area should be free." "Do you not consider it would be a glorious thing for the nation to hand down to posterity the two great men of both services, land and sea, on the same spot, and whom England had produced in the same war, and at the same time?"—"Most desirable." "But the spot you would select would not be the area in Trafalgar-square?" —"I think not."

Answers to Questions proposed to the Witnesses by the Committee, to which they were requested to furnish Answers.

> QUESTION I.—What effect, in your opinion, will a column, of which the pedestal including the steps is 43 feet high, and the height altogether 170, have upon the National Gallery?

Answer by Edward Blore, Esq.—An object of the magnitude of the column in question, that is, including the plinth, 170 feet high, and occupying so prominent a position, whether considered as an ornamental object or not, will form by far the principal feature in any point of view in which it may be considered, and the National Gallery and the surrounding buildings will only have the effect of back grounds or accessories to this principal feature.

Decimus Burton, Esq.—The column will apparently diminish the size of the Gallery.

Sir Francis Chantrey.—Although I have attentively examined Mr. Railton's very beautiful perspective drawing, and Mr. Barry's plans, yet, in the absence of a geometrical drawing, or a model, showing the relative height of the column with the adjacent buildings, they do not convey so clear a conception to my mind as enables me to give a decided opinion; perhaps to the more practised understanding of an architect they may be sufficiently intelligible; I cannot, however, believe that a column, or other ornamental object, placed where this is intended to be, can injure the present appearance of the National Gallery, except so far as it may interrupt the view, and perhaps tend to lower its apparent altitude.

T. L. Donaldson, Esq.—It will render the inadequacy of the National Gallery for the important position which it occupies still more apparent: the want of altitude in the National Gallery, the littleness of all the features, the number of parts into which the elevation is divided, are so many circumstances which give an insignificance to the building. If any other ornamental erections are to be placed in Trafalgar-square, and restricted to being subordinate in scale to the National Gallery, the area will consist of a vast space occupied by insignificant objects. The only way to restore to it that importance which it deserves, and which it has lost through the National Gallery, is to place within it a lofty towering edifice, to which all the buildings around will be subordinate, and form the background. I conceive, therefore, the size of the proposed column to be no objection.

Joseph Gwilt, Esq.—A column, whose pedestal is to rise to the height of 43 feet, of proportionable width, will, in every view from the south, have the effect of destroying whatever unity of design the National Gallery possesses, by cutting it into two parts, equal or unequal, as the place of the spectator may be varied. This, of course, can only take place in the view from the south. As respects its grouping with the Gallery and other buildings about it, as seen from the eastern and western sides, I do not think it possible that it can in any position be seen advantageously in connexion with them. This opinion is founded on a survey of the spot itself, with the proposed pedestal and steps set out by the eye; but as the matter is reducible to strict mathematical reasoning on a plan and section of the ground and levels of the neighbourhood, it may be tested by such means to positive proof, by drawing lines, touching the boundaries of the pedestal from every point of view, and continuing them to intersect the façade of the National Gallery, by which will be seen the portions of it intercepted. The portico, the best part of the building in question, will thus be found to suffer much more than the subordinate parts.

Philip Hardwick, Esq.—I am of opinion that a column of which the pedestal including the steps is 43 feet high, and the height altogether 170 feet placed, as it is proposed to be, in front of the National Gallery, and in a line with the centre of the portico, must in certain points of view, on approaching it from the south, conceal so much of it, that its effect cannot be favourable on that building.

Sidney Smirke, Esq.—I think that the column and its pedestal will have the effect of detracting, in some degree, from the importance of the National Gallery as an architectural object.

Sir R. Westmacott.—I am of opinion that a column, of which the pedestal including the steps is 43 feet high, and 17 feet wide, and the height altogether 170 feet, will be injurious to the effect of the National Gallery.

QUESTION II.—What effect, in your opinion, will the said column have as an ornamental object, in combination with the surrounding buildings?

Edward Blore, Esq.—The effect of the column considered as a whole, in combination with the surrounding buildings, will vary very much according to the different points of view in which they are seen, offering with every change of position, some new combination of greater or less merit.

Decimus Burton, Esq.—To render those buildings less important.

Sir Francis Chantrey.—This question involves all the difficulties contained in the first. As an ornamental object, the beauty and just proportions of a Corinthian column, as forming part of a building, are matters settled 2,000 years ago; what its effect may be standing alone must depend much on the base, and the object which crowns the summit. An injudicious association of modern things with ancient may put the column out of the pale of classic beauty. Of the statue which is to be made I can give no opinion, but if it be only to measure 17 feet, its bird-like size will not be much in the way, and if formed of Portland stone, will not be long in the way. The Trajan, the Antonine, and the Napoleon columns, are the only monumental objects of this class that I have ever looked upon with entire satisfaction; I read the history of the man on the shaft of the column, and the mind is thus reconciled to see the statue so elevated. I may be told we have not money enough for a work of this character, that naval exploits furnish bad materials for sculpture, or that the arts of this country are in too low a state to accomplish so noble a work; then I say, abandon the impossibility at once, and try something more in keeping with our means and our genius.

T. L. Donaldson, Esq.—An advantageous effect: as the judicious design prepared by Mr. Barry for laying out the area will mask to a great degree the distortions and inequalities in the levels, and the irregularities in the plan, and render them inapparent to the general mass of people. St. Martin's church is already of such a scale, and so peculiar and distinct in character, that it cannot suffer from the column. The masses to the east and west, although imposing in style, are not sufficiently monumental to deserve any sacrifice being made to them; and the National Gallery is so insignificant as to require some other object to redeem the opportunity which has been lost.

Joseph Gwilt, Esq.—I do not think the proposed column will combine so as to group well with any of the surrounding buildings, and least of all, if there be any difference, with the National Gallery. In this the intention seems to have been to preserve a strictly Greek style, in contradistinction to one of Roman or of Italian character, whereof the small inclination of the pediment seems to be such an indication, that a vertical feature (such as the column would be) rising through it, I think likely to produce even a ludicrous effect. Viewed with the group of buildings on the east side of Trafalgar Square, (St. Martin's church excepted) I do not think any bad effect would be produced, because I do not consider them as of sufficient architectural importance to weigh in the matter; but with those on the west side, and also of St. Martins portico on the east, and to the south-east with a building of great architectural merit and consistency, I mean Northumberland House, I see no lines about the column nor its appendages which make it desirable to choose such a site for it as that in question.

Philip Hardwick, Esq.—Architectural objects well designed, and of good proportion, almost invariably combine well with surrounding buildings, and I think it probable that such will be the effect of the proposed column.

Sidney Smirke, Esq.—It will have the same effect upon all the adjacent buildings; but, when viewed as a whole, in combination with the surrounding architecture, including the intended terrace, &c., I should expect that a very fine architectural scene will be produced, however much each building composing the group may suffer in individual importance.

Sir R. Westmacott.—As an ornamental object, in combination with the surrounding buildings, I cannot hesitate in saying, that I think the effect of the column itself and those buildings, from the absence of harmony of proportion with each other, will in itself be bad; and considered in reference to those buildings, by reducing their scale, and more especially of St. Martin's church, have an injurious effect on those edifices.

QUESTION III.—What effect will the column have on the National Gallery, as you approach it from Whitehall?

Edward Blore, Esq.—As regards the National Gallery, the combination as you approach it from Whitehall will be one of the least favourable, inasmuch as the column in this point of view will cut the portico and dome of the National Gallery almost through the centre; still, however, it must be borne in mind, that the National Gallery, from the superior height and the prominent position of the column, will in this point of view (pictorially considered) have only the effect of a back-ground, an effect which will be more obvious from the great distance interposed between the two objects, and the aerial tint which the more remote one will acquire by this distance; so that the disadvantage of combination will be very much mitigated by the relative distance of the objects, and the atmospheric modification resulting therefrom.

Decimus Burton, Esq.—Its pedestal will obscure a portion.

Sir Francis Chantrey.—I expect that when the column and the National Gallery are seen together in their whole extent at the same moment, which will be the case when viewed between Whitehall and Charing-cross, that the Gallery, as I have said before, may suffer somewhat in its apparent height; but I do not regard this as of much importance, when I consider that Mr. Barry's plan of sinking the base line 10 or 12 feet, must improve the elevation of the National Gallery considerably.

T. L. Donaldson, Esq.—The Gallery will then form a subordinate background to the column; the portico, which is the least exceptionable feature in the building, will be intercepted; the cupola over the centre is too paltry in scale and character to render the interposition of the column, when seen from Whitehall, of any consequence.

Joseph Gwilt, Esq.—This is answered in the reply to Question I, and it would be easy to show, by carrying out the test there proposed, that whatever importance the National Gallery possesses, will be destroyed by placing the column on the spot selected.

Philip Hardwick, Esq.—The answer to this question may be considered as included in that to the first, as it is in the approach to the National Gallery from the south or Whitehall, that the effect of the column would be unfavourable to that building.

Sidney Smirke, Esq.—From the more distant parts of Whitehall, the column will be the most conspicuous object, and will of course interfere with the present view of the National Gallery; and when the spectator advances, say to the door of Messrs. Drummonds' bank, I apprehend that the pedestal of the column will pretty nearly exclude from view both the portico and dome of that building. I would suggest the erection of a slight boarded scaffold, representing three sides of the pedestal and base; the Committee and the public would then see, without the exercise of any imagination, the actual effect that would be produced by that the more bulky part of the monument.

Sir R. Westmacott.—It would have the effect at the distance of Whitehall of concealing a great portion of the portico; and on a nearer approach to Charing Cross, the pedestal of the column being seen at an angle, and increased several feet in width, would obstruct the view of two-thirds of the portico, and a considerable portion of the west wing of the National Gallery.

QUESTION IV.—How far do you consider that position a favourable position for the column itself?

Edward Blore, Esq.—I have no hesitation in stating that, in my opinion, the position is peculiarly favourable for a lofty object, such as a column or obelisk, provided it be in good proportion, and designed with good taste; and that, taking into consideration all the circumstances of the ground, and the surrounding buildings, that no substitute could be found for such a form to produce an equally good effect.

Decimus Burton, Esq.—For the column itself, a very favourable position.

Sir Francis Chantrey.—I consider this position to be the most favourable that can be found or imagined for any national work of art; its aspect is nearly south, and sufficiently open on all sides to give the object placed on that identical spot all the advantage from light and shade that can be desired; to this may be added the advantage of a happy combination of unobtrusive buildings around; but to conceive a national monument worthy of this magnificent site is no easy task.

T. L. Donaldson, Esq.—One of the finest in the world. The best possible position for a lofty monument is when the spectator comes upon it unexpectedly, and when it can only be seen from a short distance; Trafalgar Square unites in an eminent degree both these requisites. To those approaching from the Strand and Pall Mall, it will come upon them by surprise, and the column will present itself in all its grandeur. To those approaching from Westminster, it will appear majestically on a rising ground, with the contrast of the low National Gallery behind it, to increase its apparent size; both which circumstances will give it dignity. The eye can embrace without inconvenience an area of 60 degrees; but it is no objection to the dignity of an object, that it compels an effort on the part of the beholder in order to embrace all its parts; and the very circumstance of those approaching Trafalgar Square from the east or west being obliged to raise their heads, and use some exertion in order to see the full height of the column, will create an impression of dignity upon the mind; and the first emotion which a monument produces upon the spectator is all-important. When a lofty object is first seen from far, and kept in view up to the moment that the beholder gets close up to it, the impression is not so overpowering, however small may be the other objects which may surround it, as when it bursts suddenly upon the view close upon him. The gradual approach to it from a distance begets impatience and weariness; the impressions of grandeur only progressively develop themselves, and are therefore comparatively weaker. The ancients well understood this; their temples were never seen isolated and from far; they were always surrounded by colonnades and enclosure walls. The column of Trajan was on one side of a square court of small dimensions, probably not more than 100 feet square.

[And see General Observations by T. L. Donaldson, Esq.]

Joseph Gwilt, Esq.—I do not think the position favourable for any columnar monument; because when such a form is selected, it is, in my opinion, desirable that the whole, or at least the greatest part of the outline, if it be good, should be distinguishable or marked against a back ground, whose colour and quality are different from the material whereof it (the column) is composed. I would instance, in illustration of my meaning, the effect of the back ground of trees and sky, in walking down Regent-street from Piccadilly, on the Duke of York's column; and in Paris that of the column in the Place Vendôme, in walking from the Boulevard down the Rue de la Paix towards the Tuileries gardens, the foliage of whose trees and sky above give peculiar value to the outline and its effect. The effect of the majestic and beautiful Column of London, perhaps the finest in Europe, would, I believe, be vastly improved if it could be seen in a long street or centre of a square, whereof it only intercepted the portion of a vista, and became thus susceptible of having its form thoroughly developed, instead of being backed on three sides by mean buildings, which confuse its forms, and tend to render them mixed and indistinct, except under broad lights.

Philip Hardwick, Esq.—There are so many circumstances in favour of the position selected, that I am of opinion it is altogether an eligible site for the column.

Sidney Smirke, Esq.—I think that the situation in question is a most favourable one for the monument; if no site for it be adopted but one where it would not affect the apparent magnitude of adjacent buildings, it must be removed to the middle of Hyde Park or Regent's Park, where it would be entirely thrown away. I would not, out of regard for the surrounding buildings, be afraid of the height of this monument; to give it all the effect of which it is capable, should be, I think, the paramount object; and with that view, instead of dropping it down to a ground line sunk below the level of the terrace, I would lift it up on to a terrace levelled out from the portico of the Gallery; and, may I venture to add, I would have selected a design for this monument that could be prudently built without the serious curtailment of its dimensions which has been found necessary.

Sir R. Westmacott.—As a site for the column itself, or indeed for any monument, (without reference to objects now erected.) the position referred to is most favourable.

C. R. Cockerell, Esq. R. A.—In answer to the first and second questions of your Honourable Committee, on the proposed column in Trafalgar Square, I beg leave to offer as my opinion, that such a column, on a pedestal 43 feet high, the whole being 170 feet high, will have no ill effect on the National Gallery and the surrounding buildings, on the score of its scale and dimensions, viewed from the north, west, and east sides of the square, because I believe that the juxtaposition of colossal and ordinary proportions has been practised in all times and in all styles of architecture with success, especially by the ancients, who observed this principle more strictly than the moderns; witness the column of Trajan, in an area 82 feet by 62 feet: that of Antonine, in a square not much larger; the ivory and gold colossal statues of Jupiter and of Minerva, which occupied the entire nave of their temples. Again, the Tower of St. Mark, at Venice, 42 feet wide at the base, and 316 feet high, in a square 562 by 232; the Column of London, and that of the Duke of York; none of which can be said to deteriorate from the architecture in connexion with which they are seen. The placing such colossal objects in extensive areas, as in the front or St. Peter's at Rome, Place Louis XV., at Paris, at St. Petersburgh, and other places, is wholly a modern practice, and a departure from the principle of effect on which they were originally founded by the ancients. My conclusion therefore is, not that the proposed column is too large for the site, but that the site is too large for the full effect of the proposed column.

With reference to the third question of your Honourable Committee, I beg leave to suggest that the principle in question appears to apply to colossal objects seen rather from a near point of view than from a distant one; because, in the first case, their position with respect to the objects beyond is altered with every step of the spectator, and the contrast and combination of their ever varying forms with those in the back ground may be advantageous to both; but in the latter case, where the gross disproportion is viewed almost geometrically, is unrelieved by detail or change of form, and fixed, during an approach from some distance in a straight line, the interposition of such an object actually exceeding the height of the entire building, and growing larger in the advance towards it, must divide and disunite the whole composition of the back ground, and obstruct the view of the central feature by its bulk, to its great disadvantage.

I believe it will be found the constant practice of the best architects to consider the central object in front of a great building, as a scale for the appreciation of its magnitude, and to make it always subordinate to the uninterrupted view of its principal feature. Thus the statue of Queen Anne, before St. Paul's, presents an admirable centre and scale to the whole front, without in any degree obstructing its view. The statue of King Charles plays the same part, with reference to the National Gallery, from Whitehall Place, and the contrast is greatly to its advantage in approaching from Parliament Street. The proposed column would supersede that well-proportioned centre, and present a succession of centres, contrary to the usual architectural practice, which places successive objects at the sides, but never in the centre of an avenue, especially when such centres would obstruct the view of a fine object in the back ground.

In answering the fourth question of your Honourable Committee, I am constrained, for the above reasons, to offer my humble opinion, that the proposed position for the column is not favourable to it with reference to the whole square, nor to the National Gallery as seen from Whitehall. And in differing, with very great regret, from the able architect who has suggested this position, and the distinguished Committee who have sanctioned it, I feel myself in candour bound, with your permission, to offer some further explanation, both in fulfilment of my duty towards your Honourable Committee, and the great public object you have in view, and in deference to those gentlemen, since my judgment may have been biased by a preconceived view of the subject, which may apologise for the objection which I have ventured to express in reply to the questions of your Honourable Committee.

I was not able to offer the result of my reflections on this great national intention in the general competition, but deeming the square too large to admit of a central column with that effect which the ancients attained, I had always conceived that the proposed memorial of a naval commander should occupy one side of the square, leaving the other for a future and at least equally interesting record of a military commander.

Two such columns, placed at the distance of 70 or 80 feet from the south angles of the square would connect its somewhat straggling proportions, present an admirable picture in emerging from Charing Cross, and leave the Gallery open; they would group admirably in the views from the Strand to Cockspur Street, they would conceal the defect of the inclined roads, according to the long projected terraces now forming, and their colossal proportions would gain greatly by their juxtaposition to the buildings. By such an arrangement the whole area would be left open for all those monuments which in process of time will, we hope, increase upon us, reproducing that altis, or forum, in which the gratitude of the country may be expressed in all the variety of design suited to the situation.

It will be remembered, that the enthusiasm of the country placed the remains of the immortal Nelson in the centre of St. Paul's, as if no future hero could deserve such a position, and perhaps a much greater than Nelson will have to be recorded by us; if, therefore, the centre of Trafalgar Square is now to be occupied, it is certain that no other equally large monument can be erected there, and yet it would be difficult to find elsewhere, in the metropolis, a site equally eligible for such a memorial.

I trust these observations in explanation of my view of the whole subject, may not be deemed obtrusive by your Honourable Committee.

John Deering, Esq.—I think the proposed Nelson Monument presents that precise character of altitude most to be desired at the particular site intended, where a great and wide street of entrance necessarily branches off right and left into a principal artery of the metropolis, and where the idea of termination is the impression most essential to be avoided; for we must recollect that the object is not to arrive at Trafalgar Square or the National Gallery, it is to convey to the mind of the stranger the true and peculiar character of our capital, its endless continuation.

If this view be correct, the worst object would be a plain unbroken mass, which like the County Fire Office to its site (grasped by the eye at once), conveys the idea of obstruction, and limits consideration to its own pretensions alone, as the sole object of the whole arrangement. The broken line of architecture in the National Gallery obliges the eye to travel along its length, but the proposed form completely gets over the difficulty, presenting a magnificent object in the vista of approach, while it leaves the idea of space beyond, and suggests the idea of divergence, without obstruction, where that idea is most essential.

I cannot suppose the effect would be unfavourable upon the National Gallery, for although that building could be no longer seen in its whole extent from any point more distant than the column, I doubt whether its broken character of outline and laboured details, as well as smallness of parts, do not require that it should not be seen, as a whole, beyond the distance whence those features could be visible at the same time, and so form as it were a part of the design; but on the whole, I think it equally certain that, in its magnitude, this monument, in reducing to comparative insignificance, not only the Gallery, but St. Martin's Church, (its pedestal beng nearly as large as the portico, and the whole nearly as high as the spire of that building,) will not also be a monument equally unfavourable to the memory of those who spoilt the National Gallery inside and outside for the assumed sake of a building, of which the unimportance will be thus placed in its true light.

But notwithstanding, we must not forget that the great end should be to adorn the metropolis, and not to persuade the unwilling of the architectural beauty of Trafalgar-square, or any particular building around its circuit.

General Observations by T. L. Donaldson, Esq.—The opinions I have given are strictly confined to the questions put in reference to the column, and I therefore do not offer any judgment as to whether any other arrangement of Trafalgar-square would be more advantageous. As the Nelson column must necessarily, from its size, be the most important feature in the area, it is essential that it should form a central object, as it were, to which all the rest must be subordinate and merely contribute. Size alone will not be sufficient. It is to be hoped that its decorative embellishments should be of a character consistent therewith: a denuded mass of masonry, however gigantic, will have a mean effect, and bear a parsimonious character disgraceful to the nation The examples of the ancients and that of the moderns prove, that the enrichments of sculpture, and a due decoration in the subordinate parts are essential to convey all those impressions which it is necessary to produce when erecting a monument to the honour of one of the greatest men of a great country. It is to be hoped that the erection of the Nelson column may not become an instance of miserable national parsimony on such a noble occasion.

APPENDIX.

ESTIMATE OF PROPOSED WORKS, TRAFALFAR-SQUARE.

		£.	s.	d.
19,214 cubic yards of digging and carting away	at 3s.	2,882	0	0
345 cubic yards of concrete	at 6s. 10d.	117	17	6
71 rods reduced brickwork	12l. 10s.	887	10	0
630 feet run, 12 in. gun-barrel drain	at 2s. 3d.	70	17	6
9,370 cubic feet of Aberdeen granite, with a fine axed face, joints and beds included	at 6s.	2,811	0	0
372 feet superficial extra sunk work	at 1s. 6d.	27	18	0
200 ditto . ditto circular ditto	at 2s.	20	0	0
1,016 ditto . ditto moulding to ditto	at 4s.	203	4	0
74 ditto . ditto circular ditto	at 5s. 6d.	20	7	0
180 ditto . ditto rock face	at 1s. 6d.	13	10	0
2,615 cubic feet of Aberdeen granite steps	at 7s.	915	5	0
Bosting and carving 16 blocks in four principal pedestals	at 4l.	64	0	0
98 Aberdeen granite posts complete, including fixing	at 6l. 10s.	637	0	0
8 pedestals in balustrade of Aberdeen granite, comp.	at 4l.	32	0	0
213 Aberdeen granite balusters	at 40s.	426	0	0
6,062 cubic feet Irish or other granite, with a fine axed face, beds and joints included	at 5s. 6d.	1,667	1	0
487 yards superficial Roman cement	at 2s. 3d.	54	15	9
2 sink stones	at 40s.	4	0	0
Cast-iron work to cable bars		220	0	0
Commission, Clerk of Works and Contingencies		720	0	0
Total	£.	11,794	5	9

June 1, 1840. (Signed) C. BARRY.

Danish Railway.—It is not generally known that a railway from Altona, two miles from Hamburgh to Kiel, in the Duchy of Holstein, has been projected, and is about to be constructed, under the auspices of the King of Denmark, with a view of effecting a communication between the North Sea and the Baltic. Mr. George Watson Buck, engineer-in-chief to the Manchester and Birmingham Railway Company has been selected as the engineer to the undertaking.

A NEW PROCESS FOR MAKING GAS FOR ILLUMINATIONS FROM BITUMINOUS SCHIST.

The utilization of bituminous schist is a subject of great importance, as promising to make this substance profitable. M. Selligue is the inventor of the process for distilling this mineral, and has works for the purpose on a large scale. His mines are in the department of Saone and Loire, between Autun and the Central Canal; his three works are at St. Leger-du-Bois, Canton of Epinal; Surmoulin, near Autun, and Igernay, Canton of Cardesse. In these works the schist is distilled in close retorts, they leave a residuum of carbonaceous matter, which may be used for disinfection or discolouration, but not yet made serviceable. The volatile products are oils consisting principally of different carburets of hydrogen, which are made available for profit. A great quantity of inflammable gases are also disengaged during the distillation, and are directed into the furnace and used as a combustible.

The schists of Autun are very variable in character, but all are rejected which afford less than 6 per cent. of oil on distillation, but those now used average 10 per cent., it is not rare however to find as much as 20 or 25 per cent., some were as much as half their weight of oleaginous products.

The composition of 100 parts of liquid bitumen is as follows:

Light oil of variable density from 0·766 to 0.810, used for gas	35·57
Oil of greater density susceptible of being used in lamps	25·85
Fatty matter containing 12 per cent. of *paraffine*	12·
Pitch or tar	17·28
Residue	9·3
	100

It has long been suspected that the olefiant gases derive their illuminating properties from the oleaginous vapours which accompany the generally slightly carburetted hydrogen gas which always forms the base of these gases. M. Pelletan maintained this view in a paper read before the Academy in December 1816, and it has been confirmed by M. Selligue. It has been on the other hand asserted and received as certain that oxidated carbonic gas is always injurious in illuminating gas, and that it diminishes the brilliancy of the flame by lowering its temperature, on account of the low degree of heat developed during its combustion. M. Selligue has however established the fallacy of this doctrine.

M. Selligue's process is as follows:—Three tubes or retorts, situated vertically in a new and ingeniously constructed furnace, are heated red. The first and second contains charcoal, and as fast as the charcoal disappears it is replaced, which is every five hours. This carbon is for the purpose of effecting the decomposition of the water introduced into the first tube in a continued stream, and where it is converted into hydrogen gas, and carbonic acid, and oxide of carbon. But as the production of carbonic acid is to be avoided, the gases produced by the first tube are conducted into the next, where they are exposed again to incandescent charcoal, by which means the carbonic acid first formed is converted into oxide of carbon. The furnace is so arranged that this tube is the hottest of the three, so as to favour the total decomposition of the carbonic acid.

The third tube is fitted with iron chains, the use of which is to present a large incandescent metallic surface, capable of distributing caloric in an equal and rapid manner to the gases or vapours passing through. On the one side this tube receives the gases produced by the decomposition of the water in the two preceding tubes, and in the other a continued stream of *light schistose oil.* This light oil is decomposed into new products still more volatile, and passes with the gas into a refrigerator, which by cooling down the products causes some of them to reappear. The schistose oil is therefore not entirely gasified, but that which does not change into gaseous matter is preserved uninjured. What is very singular is that the links of the chain in the tube are never covered with any carbonaceous deposit. Thus while the schistose oil is evidently decomposed by heat during this operation, its decomposition is modified in a successful manner by its diffusion amid a large volume of gas, such as that produced from the decomposition of water, and which serves as a vehicle.

From the third tube is produced hydrogen and oxide of carbon, produced from the decomposition of the water, and the gases or vapours from the decomposition of the oil. By passing into the apparatus 20 gallons of water, and 25 of schistose oil, 50,000 gallons of oil fit for illumination are produced in twenty hours. The gas so produced requires no farther purification, having passed through a refrigerator where are deposited the nondecomposed oil, and steam from the water. From the refrigerator the gas passes into the gasometer.

M. Selligue's process and apparatus are represented as being so simple, as to be easily used in factories and private establishments, while the price of the gas so produced is low enough to be employed for lighting the streets. It has been proved by experiment not to deteriorate, but to improve at a distance from the gasometer; at five miles distance the flame was purer than when just issuing from the gasometer. When cooled down to 13° F. below zero, its illuminating power was not sensibly diminished. The gas is also free from sulphuretted compounds, and gives no unpleasant smell. The odour of coal gas, we may observe, however, is attributed by some chemists to vapour of naptha, and not to sulphur solely. As it does not act upon metallic reflectors, M. Selligue is able to use these additions with great advantage, so much indeed that with a parabolic reflector one of his burners enables a middling size print to be read 80 yards off.

M. Selligue has set up gas apparatus at the Royal Printing House, and the Batignolles at Paris; at Dijon, and other cities, all of which work well.

We may observe that this process is on similar principles to that of the air light, in which air was decomposed and the oxygen burned with oily or bituminous matters, and in this case water is decomposed and the hydrogen similarly combined.

STONE FOR THE NEW HOUSES OF PARLIAMENT.

Sir—I wish your correspondent in No. 33 of your valuable Journal who stiles himself "Amicus," had done that which he started to do in the first part of his letter, or at least what he pretended his epistle should do, and have endeavoured to correct the many "inaccuracies and misstatements," which have already appeared, and not have added to their number by writing the letter under notice, which is nothing more or less than a perfect puff, to extol his fortunate purchase of "Mansfield Woodhouse Quarry," as well as his other "White Sandstone Quarry," as he calls it.

It is very true and well known that Commissioners were appointed by Government to select the best material the united kingdom could produce, as to durability; and well they have performed their task, certainly. In the first place they only go two-thirds over the kingdom, leaving out the only part that could yield them the article wanted, such an article as is to be found in most parts of Ireland, for it is well known that that country abounds with stone of an *undecaying nature* (as for instance look at her "Round Towers,") and selected a material not half so good as that which could have been procured as above, and from a quarry too according to their own showing, that could not produce the necessary quantity or blocks of sufficient magnitude for the purpose intended, as witness the Report published by the House of Commons (which any one can purchase for sixpence), there it is stated the depth of workable stone to be only "12 feet," and the size of the blocks to be no more then from "8 *inches to* 2 *feet.*" Now how can such slovenly conduct be tolerated, but this is not all, for as "Amicus" shows, they were within a few months obliged to abandon this mighty quarry and seek a new one, in the newly discovered quarry purchased by Mr. Lindley, alias Amicus, which that gentleman states to be of a quality and character precisely similar "to that of the beds on the Moor," if that is so, and we have no reason to say otherwise, then the stone will be found wanting in the same manner as the Balsover, in not possessing blocks of the size required. So much for "Amicus," having set at rest the "inaccuracies and mis-statements," that have gone abroad. But before I have done, I must ask him a question or two, which no doubt he will be enabled to answer, which will show how the public are generally imposed on in jobs of this nature, has the New Mansfield Woodhouse Quarry been enabled to supply the Works yet, with either quantity or quality as to size of blocks, or will it ever? If it has, why have the said works been so nearly at a stand still for some time, and why has the *Steetley Quarry* been applied to for the required supply, and whether that application has not been answered by the sending of great quantities to Westminster to carry on the building? And lastly, though not the least point of the business, whether this said stone has ever been tested by the Commissioners aforesaid? If so, I can find no report thereof, which ought to have been done, the public having a right to expect that no material should be stealthily used in their national buildings without having it duly tried in all possible ways, particularly after the heavy sum that has been paid these gentlemen to protect their interest and fame.

If these questions are well and truly answered, then indeed will "Amicus" be correcting the "inaccuracies and mis-statements" that have gone abroad, and be rendering the public infinite service by showing them how they are generally hoodwinked in such matters.

I cannot conclude this letter without referring him and your readers to a most excellent article in the same number, "On Limestone in Ireland," by W. Bald, F.R.S.E., &c., a gentleman of the very first rate talent and ability, which I have no doubt has been duly seen and read by all who are fortunate enough to take in your valuable journal, but should it have escaped the eyes of any, I can only say it will well repay their looking back to and reading it with attention, then all will I am sure bear me out in my censure of the neglect, nay insult that has been offered to Ireland; particularly as to the stone that has been tendered (at least so I have seen stated in several of the public prints) *gratis* to the public.

I have the honour to be, your's,
A Lover of Fair Play.

[We always view with suspicion any offer that is made *gratis*—it is frequently a complete delusion. We have also heard of offers being made by noblemen and gentlemen to supply the stone for the New Houses of Parliament *gratuitously*. but when the offers were sifted, they were generally found not worth accepting, for what is meant by the word *gratis*, in this business, is to supply the stone embedded in the quarry, which may be generally obtained at any new quarry upon paying a *royalty* of 1*s*. to 1*s*. 6*d*. per ton, or about 1*d*. per foot cube—this royalty forms the most trifling part of the price of stone—the cost is made up by the heavy and unavoidable expences of quarrying, getting, carriage to the water side, and freightage. Besides it is often found that the stone is of such a hard quality that the labour upon working it, is double the price of another stone which fully answers the purpose—for instance the labour upon granite in working it in gothic mouldings is treble the price of labour on Portland stone, and the same with other stones and marbles; which would render the cost of the stone work of a building when worked, nearly double, if not more; thus instead of the country gaining by the gift, it would be very materially the loser—so much for *gratis*. As to the injustice to Ireland, the Scotch might as well complain of the refusal of their granite which was offered by a nobleman to be supplied gratuitously; but when it was explained to him that the cost of the stone when worked would be far more than the stone which is being supplied for the New Houses, he immediately acknowledged that his offer was not worth accepting.—Editor.]

IMPROVED LAND SURVEYING CHAIN.

Sir—Observing in a former number of your Journal a description of an improved surveying pole, I venture to trouble you with an account of what I consider an improvement which I have lately made in the chain, namely, having the 11th, 21st, 31st, and 41st links made of brass, the rest being of iron; by this arrangement the brass link, being in all cases nearer the middle of the chain than the token, will at once point out whether such token be 10 or 90, 60 or 40, &c., and as a matter of course the liability to mistake 40 for 60, and so on, entirely done away with. In mineral surveying a chain of this construction is incalculably superior to one of the old.

If you think the hint is likely to be useful to any of your readers, I shall feel obliged by your giving it a place in the Journal.

Most respectfully your's,
William James Hindle.

Barnsley, Aug. 3, 1840.

PARISIAN AND LONDON HOUSE BUILDING.

[The following, from a series of letters in the "Dublin Evening Post," is, we conceive, well worthy of being transferred to our Journal, where it will be better and more conveniently preserved than in the columns of a newspaper. Besides some direct information, it contains some clever and pertinent remarks, although we do not subscribe to every one of the writer's opinions.]

Paris, as a city, pleases me more this time than last year, though it cannot boast of the grace of novelty in my travelled eyes. But I have looked, and am endeavouring to look through it more carefully. There is a cheerfulness in the warm colouring of the buildings in that beautiful stone, of which the city is made, which cement can never imitate. It is not one gray, uninteresting, and monotonous brick like Dublin—nor, like London, is the dirty and smoky red interrupted in some quarters of the town by the masks of stucco, of all colours and in all states of decomposition, which covers the skeleton palaces. The finest and most showy parts of London are gingerbread and pasteboard to the buildings here. I doubt not, however, to an unpractised eye, several parts of London—I am not now talking of public buildings—will appear as fine as the general run of houses in this city—such as the shops in Regent Street, and the mansions in the Regent's Park. I select these, for they were the first erected under the new system. They were the earliest efforts of George IV., a man magnificent enough in his aspiration, but of a taste most tawdry and glaring. He wished, apparently, to say, with Augustus, that he found his capital of brick, and that he left it of marble. But he forgot that the Roman Emperor spent his life—and he attained the purple at a very early age—in building up the *alta mœnia Romæ* such as Attila found it—and that he had, in the mean time, the absolute command of all the riches of the world, and of the genius of Greece and Italy—those riches for such purposes would have been useless. The Regent of England—and he deserves some credit for the design, childish and ridiculous as it was, inasmuch as it evinced the presence of some germs of imagination in a man whose character was stained by many degrading vices—the Regent, I say, thought to accomplish, in a dozen years, what occupied the entire reign of he second Cæsar. He set about the scheme with great zeal—he had ready a class of secondary architects—he had drawings and plans in abundance—and, above all, he had the sanction of Parliament. To work he went—but it was not to marble, nor yet to Portland stone, or to granite that he applied himself—it was to making Roman cement. It was to plastering the houses with a very pretty, nay excellent composition, I admit, and cutting out the fronts of the dwelling-houses as Temples of Theseus, Parthenons, Acropolises, and fanes dedicated to the winds. All was dirty and perishing brick within—without all was a coating of architectural painting. And then the strange variety in which all orders and ages of architecture were jumbled together. The tailor's house had a Grecian portico, and his next door neighbour, the draper, rejoiced in a Gothic castle. Here was a temple of Bacchus—there was a thing somewhat resembling a Chinese pagoda, only more full, if possible, of pretension and exaggeration. You saw at a glance, that this part of the city of London was made for the nonce—that it was gotten up for a show—that it was fine and glaring scene-painting, not half so fine, or half so striking as Stanfield's sketches, because the designs and the executors of the plan had not half the genius of that excellent artist. But let me be just. The design of trying to alter the dirty and ferruginous aspect of London was commendable; and if he deserves any praise for anything—an hypothesis upon which I am very unwilling to insist—George IV. is entitled to some commendation for what he attempted, rather, certainly, than for anything he accomplished. An impulse was given to architectural improvement, in a city which, though it contains many splendid edifices, was, until this endeavour was made, the most uninteresting—and, may I not add, notwithstanding its situation on a river twenty times more magnificent than the Seine, the hugest and ugliest collection of brick and mortar in the world—nothing but tiles and brick. Why, there is the Corporation of London—I have seen the halls of some of their guilds made to dine—and principally made for that purpose—seven or eight hundred individuals—I have seen one which was as big as a Methodist meeting-house, and as ugly as a barn; the building itself (and it was a new one when I saw it) was placed in a nook or alley, and piled up with brick, I know not how many *fathoms* high. The money expended to make such an edifice, would, in Paris or in Petersburg (a city of yesterday), produce a beautiful building, architecturally elegant in the exterior, and containing within all the accommodation—all the appurtenances and means to boot, of dining gloriously on green fat, and getting gloriously drunk with dancing champaign. The truth is, that until a recent period, John Bull was thinking of nothing even in his public buildings, but being *comfortable*—a word that he delights in, and which you hear in France pronounced with great *gusto*—John insisting, truly, I believe, that the French language is without an equivalent term—his notions of comfort, however, in this regard, being confined to eating and drinking. The admission is due to George IV., I must repeat again, that to his absurd zeal, in trying to convert the brick of London into marble, the *real* improvements which that great city is now in the process of acquiring, may be fairly enough attributed. A better order of architects are forming; private buildings, as well as public, are not any longer left to the taste of the bricklayer, or the cunning of the carpenter. The two-foot rule and the plummet are indispensable, and the builder must employ them; but it has been found out at length that there are other things indispensable in building an edifice for an imperial city. When sought for, talents of the kind required are always to be found. They existed in what are called the dark ages, when Westminster Abbey and Rouen Cathedral were built. It would be an uncourtly satire on England—it would be a most false misrepresentation of her intellect, ingenuity, and taste, to pretend that architects would be wanting if they were required. They are not wanting. It is true the National Gallery is a national disgrace, and the Royal Exchange, when it arises from its ashes, may prove an ignominy, if the city don't look to it; but, on the whole, within the last twelve or fifteen years, the signs and tokens of a better order of things are manifest even to an observer the most cursory. But *ages* must elapse before London can be what she ought to be architecturally, and what she will be, no doubt, should she hold, as she has done, with such transcendant glory, the sceptre of the seas.

But Paris has been, since it first became *great*, an *architectural* town. During all her eventful history, her public buildings held a prominent place in the minds of her kings and politicians. The French are fond to madness of glory—of martial renown principally—but all sorts of fame, even to the making of a cap or periwig, are prized, perhaps, beyond their value. They value themselves upon their poets, their orators, their historians, their painters, their architects. In Louis XIV. they had a king who was as vain as any of his subjects on all these national *vanities*—if you will, a king, too, that had the power to execute his will, at any expense of treasure and oppression. The policy of his reign may be questionable, and he may have been himself a tyrant; but he adorned Paris, and he completed Versailles. It was pride, if you like, and selfishness; but to it the present generation is indebted, at least, for fixing, propagating, and, I think, perpetuating the taste of the people in this regard. The *improvements* of Paris began nearly two hundred years ago, and they have been in constant progress. Those of London are scarcely thirty years old. But, in the interim (of 200 years) London has increased nearly fifteen fold in population and houses, while Paris has certainly not been trebled. At the commencement of the reign of George III., a comedy—I forget the name—was produced—I saw it acted myself, when they used to play comedies—in which two interlocutors are introduced, discussing the relative population and size of the two greatest cities of Europe. In those days, statistics was no science; but, the circumstance is enough to show, without hunting your library to ascertain the truth, and missing the game, most probably, at last, that, about seventy or eighty years ago, the population of these two cities were nearly alike. In population, London is now doubled, at least, and she contains six or eight times as many houses, and consumes much more ground. But London has been built at *random*. It is not houses they *run up*—a good, familiar, and descriptive phrase—but *streets*. Aye—streets. An instance has been known of a street of considerable extent being built in three months. It takes three years to build a house in Paris; but then it *is* a house—a great house—three or four times the extent of a mansion in Merrion-square, for example. The Merrion-square house may be, and is, no doubt, more comfortable, in conformity to our notions of comfort. It contains only one family, while the great buildings I speak of gives magnificent apartments to two or three. And do not imagine that the families which inhabit these houses pay less for their houses than the gentry of Merrion-square. Two, three, and even four hundred francs a year is not an uncommon rent for these separate families in one house. Some have been mentioned to me which brings the proprietor in from £1,500 to £2,000 a year. Observe, that I am not discussing which is the best mode of living—the French or the English. For my part, I should like to have a house to myself; but *that* is not the question here. I am stating a fact with a view of showing you why it is that Paris is so much superior in its buildings to London. First, they build in Paris greater houses; secondly, these houses occupy a longer time in building; and thirdly, they are built of materials vastly superior to those employed in England. They are built of a coarse marble, or of a beautiful stone, as *I* think it is, supplied by the quarries of Normandy and the valley of the Seine—the stairs in many of them are of marble—the floors, all that I have seen of them, in the latter order of houses, are made of oak—the landing places, and little ante-rooms, are constructed of marble, or a Roman cement, or some superior preparation of tile. In short, these houses are made to *last*—not for one generation or two, but, perhaps, for ten. When finished, there they stand compact and fine, and *knit together*, with a view of enduring for centuries.

To build a house in Paris is a very serious thing; the ground rent is enormously high. You go to the stone quarry for your material, and not to the brick-field. You must employ oak instead of Canada pine. You must employ stone-cutters and masons instead of bricklayers. In short, for the private houses of the first class, that is to say, for houses in the first class of streets, you must proceed in Paris as you would in London or Dublin if you are about to design a public edifice. They are built, therefore, most substantially, and, as in public edifices, their exterior is designed on architectural principles, and with a view to suit the *genius loci*. Now, as I have said, this system has been in operation for centuries, and you can almost pronounce the age of a building, if you have given any previous time to the study, on inspection. Hence it is that, notwithstanding the vast number and beauty of the buildings made by Napoleon, and the great addition that has been made during the present improving reign, the *air* of Paris is that of an old city; while London looks, and will always look, from the material it is made of, neither new nor old, a sort of *Provisional City*, a multitudinous congregation of houses, that are constantly changing their aspect—that are constantly in a state of transition of being run up or run down—*quadrata rotundis*. But it cannot be expected that on a town passing away, as it were, with the autumnal leaves, and renewed with the swallow and the zephyr, architecture can have impressed her permanent type. Brick, however, neatly put together, will not take the impression. It is too perishable and flimsy to bear the weight of her machinery—and, indeed, it has never been tried. The bricklayers and carpenters of London content themselves with erecting houses of three or four stories high, with a comfortable basement for the kitchens and pantries, a hall, a front parlour, and a dining-room—above, two drawing-rooms, opening into each other, best bed-rooms higher up, and inferior apartments next the stairs. They are all alike—like as eggs—the only difference being in the size—from a sparrow's egg, or a pigeon's, to a duck or a goose's egg. In regard to the apartments and their disposition, you might, after describing number one in any given street of London or Dublin, write ditto against number two, and ditto to the bottom of the page, and to the bottom of the next, and to the end of the volume. It is curious that our ordinary builders exhibit such a poverty of contrivance—no taste, no variety, no resources, apparently, except in fixing a water-closet, or managing a projecting recess. I have little doubt that these deficiencies are attributable, in a great degree, to the materials we employ, and are obliged to use, as well as from long habit, which has grown up into a second nature. Houses are built, in London, to answer temporary purposes, or for the accommodation of two, or three, or four generations. They are made of brick—a perishable article—they are made of Canada deal—a decaying wood. But they answer the ends of their creation. Art, science, in the disposition of the interior, and considering also the size of the mansions, would be thrown away, or rather would not have space to move about in "the cribbed, cabined-in and confined" precincts of a London or Dublin private house. In this city, from what I have already said, you will readily infer that the case is quite different. I have been in several houses since I came to France, and I did not find two of them alike in their interior arrangements. It would be, indeed, a sad puzzle to an ordinary London or Dublin builder to make a house in the French fashion; to *design* a house like that, for instance, in which I am now residing—poh! he would eat it as soon.

But, as I have said before, a better taste is arising amongst ourselves. When people shall be convinced, that even in the construction of an ordinary building, it will not be amiss to employ an architect as well as a builder—and, I should hope, this taste is beginning to prevail, our children, and our childrens' children will see a finer London and a finer Dublin than we do now—and, *I expect* that our country-houses—I mean the houses of our gentry—if they can keep their station, which so many of them are built upon endangering, will not be made up by a country mason and his helps—but, will exhibit the common sense and understanding in which the mansions of their grand-papas have been so lamentably deficient. With respect to public buildings, the prospect for our posterity is still more cheering. Our superior artists are studying the Greek models with a zeal that promises excellent effect. There are drawings and elevations of all the architectural remains of Greece and Italy. The taste in England never died entirely, from the time of Athenian Stuart, but it slumbered in the interval deeply, until a few years after the last war. But, the pure taste to be acquired from the study of these immortal models has had to struggle hitherto with the so called Gothic, Norman, and above all with that thing, now the most fashionable of all, called the Tudor or Elizabethan architecture, of which it may be asserted, *meo periculo*, that it is the worst of all the rest—and only better than the poor, bald, and miserable system prevailing in England since the Revolution. But, Ancient Greece will conquer at last—though they are building the parliament house after a model of their own.

This is a long letter, and upon a subject which can be popular only in certain, perhaps, rather restricted circles. But, I am writing with the glorious Madeleine looking in at my window—that most superb copy of the finest and purest architectural powers of Greece. Here is a building that the eye never tires in gazing upon—so sublimely simple, so quietly beautiful, and such a magnificent array of Corinthian columns. But, I am not here to describe the Madeleine, any more than any other edifice. But, looking around me, and with this memento constantly before my eyes, I could not resist the topics which the contemplation of these objects suggested.

ON RAILWAY AND CANAL TRAFFIC.

By Charles Ellet, Jun., of the United States, Civil Engineer.

[The following judicious remarks on Railway and Canal Tolls, which we extract from the "Franklin Journal," are well deserving of the serious attention of all parties connected with either railways or canals, there will be found many hints worth their consideration.]

The object of this essay is to point out, in a brief and popular view, the consequences of some of the errors which are committed in the charges assessed on the public works of this country.

The writer has recently published a work[*] in which he has attempted to expose the true principles of trade, and to show the only correct mode of determining the tolls proper to be levied on our great lines of canals and railroads. But it has been suggested to him by some intelligent readers of that work, that the method of analysing the subject which he has been compelled to adopt in it, is not the best adapted to the pursuits of the class of readers most likely to be interested in the subject; and that some advantage might be derived from exhibiting, in a popular form, a few of the results which were there obtained by a different process. This essay is intended to subserve that purpose; and to show that the principles on which all the tariffs in the country are based, are unsound, and lead, in their application, to oppressive injustice to a portion of the community, and to great loss of trade and revenue to the improvements.

Of the Importance of the Subject.

1. There are no questions of public policy which are thought to concern so intimately the general and particular interests of the people of this country, as those which relate to their internal improvements. The consideration of this subject constitutes the greatest part of the legislation of nearly all the states in the Union, and the employment of the privileges sanctioned by the law, constitutes a prominent portion of the efforts of individual enterprise. There are now completed and in use in the country more than three thousand miles of railroads, and not less than three thousand miles of canals, the construction of which has occasioned an actual expenditure of probably 150,000,000 dollars, and for which loans have been incurred by the state governments or incorporated companies, to nearly an equal amount.

This enormous investment of capital is by some viewed as alarming; and might, indeed, appear so, when it is considered that a draft of some eight millions of dollars will be annually made on the country for the payment of the interest on this sum, and that the principal itself, in the brief space of twenty years, may possibly have to be refunded. On the other hand, there are sanguine advocates of improvements, who look to the revenue to be derived from the works themselves, consequent on the rapid growth and progressively increasing productiveness of the country, as offering an ample guarantee for the prompt payment of the interest, and the due liquidation of the principal, of the debt.

It is not the intention now to discuss this momentous question, or to endeavour to ascertain which of these hypotheses approaches nearest the truth. Both are but surmises, advanced as the result of a hasty glance at the facts, or possibly based on no safer evidence than the prepossessions, or mere conjectures, of the parties. They are wanting in that detail, that exhibition of statistical information, without which it is impossible to generalize with security.

---

[*] "An Essay on the Laws of Trade in reference to the works of Public Improvement in the United States.

Doubtless many of the works of the country will possess abundant means to sustain their credit; and among so many enterprises, it is equally probable that some have been undertaken which will fall very far short of the expectations of their patrons.

But, whatever may be the general ability of these immense lines of improvements, it is certain that the success and profitableness of those which are now progressing under the fairest auspices, are not so well established but that it ought to be an object of deep solicitude with their proprietors to find the means of increasing their productiveness. To every State that has embarked in a career of internal improvement, and to every individual who has invested his property in such stock, it is an interesting question to ascertain the most efficient means of equalizing the charges on the trade, and increasing the revenue and tonnage of the line.

The public improvements of Pennsylvania are sinking that commonwealth in debt about *a million and a half per annum*—or, in other words, the interest on the loans incurred for their construction, added to the annual charges for repairs and superintendence, exceeds the gross revenue of the works from one to two millions of dollars per annum.

Of the Incorrectness of the Principles on which Tolls are at present assessed.

To be able to appreciate the necessity of a departure from the principles on which the present charges for the use of our public works are established, it is essential to examine into the effective operation of the scale now in use. To render the view which I design to take as little complicated as possible, it may be confined for the present to one of the principal divisions of the trade of the country. For, in treating of the laws of trade, it is found convenient to divide the commerce of the line into two principal classes; in the first of which is included all those commodities which will bear but a limited charge for their transportation, and which, if taxed beyond that limit, will be excluded from the line and from market. This division usually consists of stone, coal, lumber, ore, lime, and many agricultural productions. Indeed it embraces all articles which will seek a market along the line in question, and no other; and in this respect is to be distinguished from that division of the trade which consist of more valuable commodities, and which, if not accommodated on one line, will find a passage by the route of a rival work.

Our present investigation will be confined to the first of these divisions.

The charges which are levied on this trade consist of what are usually termed *freight* and *toll*. If the work be a canal, by freight is understood the charge of the carrier, and by toll that of the state or corporation owning the work. In the management of railroads, it is usual for the company to act as carrier on their own line; and to make but one charge, which is called toll, for both objects. In this essay I shall make a somewhat different application of these terms, and designate by freight, in either case, every expense actually incurred in the carriage of the commodity, and by toll, the clear profit on its transportation. So that if the carrier, or transporting company, charge seven *mills* per mile for the carriage of one ton of any article, and the cost of repairs and superintendence of the line due to the passage of that ton is three *mills* per mile, I call the freight on the article one cent per ton per mile; and any charge exceeding this three *mills*, which is assessed by the state or company, is what I denominate their toll.

In nearly every tariff of toll adopted in this country, the charge on every article is proportional to the distance it is transported on the line. The toll is some fixed amount per ton per mile. This scale of taxation, I contend, is improper and unjust.

To examine the question, let us suppose the article to be lumber, of which the market value, at the point to which it is sent, is 10 dollars per ton. Let us also assume that the cost of producing this article, or preparing it for shipping on the canal, is 6 dollars per ton. It is then most obvious that if the charge for transportation on this commodity exceed 4 dollars per ton, it will be wholly excluded from the line; for then the cost of carriage, added to the cost of production, would exceed the market value of the article, and there could be no profit to remunerate the producer. But if the charge be less than 4 dollars, there will be a certain profit, and the article will be found to seek the market.

If now, this lumber is carried a space of 100 miles to its mart, and the charge for freight is one cent per ton per mile, the freight for that distance will obviously be one dollar, and there will remain a balance of three dollars for the extreme limit which the article will bear to be charged for toll. The toll levied by the state, at one cent per ton per mile, will be one dollar, or one third the amount which the article could in this case sustain.

Let us next suppose that similar lumber comes upon the line at a distance of 300 miles from the same mart. The charge for freight would now be three dollars, and there would consequently be a residue of only one dollar on which the state might levy for toll. The commodity could bear no more than one dollar, since that sum added to the three dollars freight, would be four dollars, or the difference between the cost of producing the lumber and its price in market. But, by the principle of taxation usually adopted, the toll assessed at one cent per ton per mile, would here be three dollars, or three times as much as the article would bear. In other words, at the distance of one hundred miles from the mart, in the usual tariffs, a commodity is charged one dollar where it might bear a charge of three, and at three hundred miles it is charged three dollars where it could bear but one.

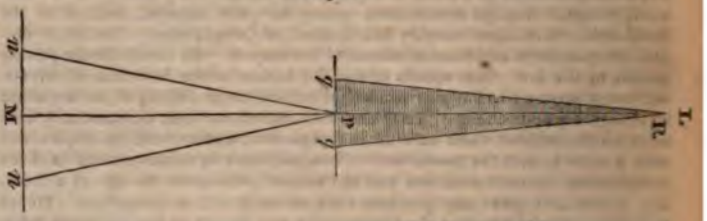
Does it need any argument to prove that a scale producing such results is neither compatible with principles of equity or good economy? Is it not manifestly unjust to charge the man who is situated 300 miles from market three times as much as he can afford to pay, while the man at 100 miles can afford to pay three times as much as he is charged? Is it not any thing but good economy to tax all the trade in this article beyond 200 miles so heavily that it is totally driven from the line, when, if the tolls were differently assessed, it might be invited, and made to pay a respectable revenue to the state? And is not the primary object of the work defeated by the adoption of a tariff that excludes those commodities from it which it was especially intended to draw to market, an effect which is accompanied by a direct sacrifice of trade, revenue, and even justice?

I think it can scarcely need more than this plain exposition to make clear to any reflecting mind that some of the charges on the public works of this country need revision; that they are based on principles which are unsound, and at once do injury to the proprietors of the work, and injustice to a large portion of the public. The commonwealth, as the constructor and owner of the improvement, is a sufferer in the loss of the trade that is excluded, and the revenue that might be derived from it; the citizens of the emporium which is the mart of the line, suffer from the contraction of their business in consequence of the exclusion of the articles in which they traffic; and the country traversed by the improvement, and taxed, perhaps, for its construction, suffers from its inability to share the benefits which the work was designed to confer.

Further evidence of the loss of Trade consequent on uniform Charges.

To render more palpable the fact that a charge for toll proportioned directly to the distance will cause the exclusion of a certain amount of tonnage without conferring any compensating advantage, we will consider the subject with the aid of a diagram. (See Fig. 1.)

Fig. 1.



Let M in the figure be the position of the mart, and ML the line of the improvement; and let us assume, as before, that the commodity will be capable of sustaining a charge of four dollars per ton for its transportation; that the toll is one cent per ton per mile, the freight likewise one cent, and the cost of carriage on the lateral roads by which the tonnage is brought to the work, is ten cents per ton per mile.

The distance M *n* from which this commodity can be brought to the mart at M on the lateral roads *n* M, *n* M, will then be forty miles; and the distance M P which we can afford to carry it along the improvement, at an aggregate charge of two cents per ton per mile, will of course be 200 miles. The area of country, therefore, which will supply trade to the line, will be represented by the triangle *n* P *n*, having a base *n n* of eighty miles, and a height M P of 200 miles.

Now, it is apparent that the line will receive no tonnage of this article, from beyond the point P; and therefore, that if the trade were permitted to come free of toll from beyond that point, there would result a certain increase of tonnage, which would be accompanied by no diminution of revenue.

Under such an arrangement of the tariff, the charge for freight from P to M, for produce coming from the country beyond P, would be only two dollars, and there would consequently be left a balance at P of two dollars out of the limit of four dollars which the article could sustain, to bear the cost of its carriage along the lateral roads to the improvement, and down the improvement to the mart.

This balance will be sufficient to pay the cost of transportation on the lateral road from *q* to P, a distance of twenty miles, at ten cents per ton per mile; and the charge for freight along the improvement, from R to P, a distance of 200 miles, at one cent per ton per mile. It would, therefore, be within the ability of the state or company, in this example, to extend the benefits of the improvements 400 miles into the interior instead of 200, and increase the tonnage of the line, with all the incidental advantages, 50 per cent., without sustaining any loss of revenue.

It is far from my intention here to advocate a tariff arranged with a view to this effect, but merely to show what is lost by those which are commonly adopted. Instead of draining only the country contained in the triangle *n* P *n*, which will supply the trade where the charge for toll is one cent, and freight one cent, by charging toll from M to P, and permitting all articles brought from beyond the angle P to pass free of toll, the shaded triangle *q* R *q* in the figure will be added to the area using the work and supplying its tonnage. The value of the improvement to the country will be increased one half; the trade of the city at M will likewise be increased one half, and the value of the property of the commonwealth, as far as it is dependent on the activity of the work, will be proportionally augmented.

But such an arrangement would effect injustice, and could not therefore receive the sanction of a government administered in a due regard to the first principles of its existence—the equal protection of the citizens, and an equitable distribution of the benefits which its constitution was intended to confer.

Such a tariff would augment the tonnage of the line—but it would produce that result by taxing the citizen immediately at P four dollars, and excluding him from the work, and the neighbour immediately beyond P but two dollars, and inviting him at the expense of a premium.

Besides these objections to this arrangement, there exists the additional and important one, that it would not fulfil another imperative condition—that of obtaining the greatest revenue from the trade.

Of the most judicious charge on articles of heavy burden and small value.

I conceive that it is essential to the fulfilment of the condition, that the tax levied on the trade of the line shall be reconcilable with principles of equity, that the charge at each point shall be proportional to the ability of the article to sustain it; and, it fortunately happens, that when the charges are regulated in the mode that will produce the maximum revenue, this condition will be fully satisfied.

We are to understand by the ability of a commodity to sustain a charge for carriage, the difference between the cost of production and the market value of the object. If the article be worth ten dollars in market, and it costs six dollars to produce and prepare it for market, it will sustain any charge for transportation, including both freight and toll, not exceeding four dollars. But its ability to sustain a charge for toll only, depends on the position in which it reaches the line of the improvement. For, after deducting the cost of production from the market value, the residue may go to bear the whole cost of carriage; but we must still deduct from this residue the charge for freight, to obtain the sum which it will bear to be charged for toll.

If, for example, the above article reach the line at 100 miles from the mart, and the freight be one cent per ton per mile, the charge for freight will be one dollar, and the residue will be three dollars. If it reach the line at 200 miles, the charge for freight will be two dollars, and this residue will be two dollars. If it come on the work at 300 miles, the charge for freight will be three dollars, and the residue will be one; and if it reach it at 400 miles, the freight will be four dollars, and the residue will be nothing, I say, therefore, that to make the tax for toll proportional to the ability of the commodity, the charge levied by the State for its passage along

100 miles should be proportional to 3 dollars,
200 miles should be proportional to 2 dollars,
300 miles should be proportional to 1 dollar,

and along 400 miles it should be allowed to pass free. From which it appears, that the greater the distance the commodity is carried, the less should be the toll levied upon it. In short, I propose that the tax should be proportional to the ability of the trade to sustain the charge; and, by such a tariff, to supersede those now in use—by which the tax is increased in proportion as the ability of the trade to bear the tax is diminished.

Now, it may be demonstrated, that when the toll is assessed on this principle, both the tonnage and the revenue will be greater than if the most profitable uniform charge per mile that it is possible to levy were adopted.

But the method of determining this most productive charge, cannot be conveniently pointed out, with a demonstration of its correctness, in a mere popular discussion. I have, however, elsewhere considered the subject in some detail, and have shown that the toll on this division of the trade which will yield the greatest possible revenue, is about three-eighths of the charge which would exclude the article from market; or three-eighths the limit of the tax which it would bear.

In the above example, therefore, the charge at

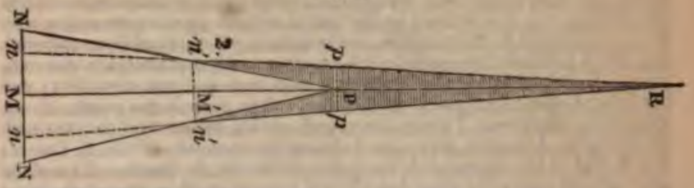
100 miles, should be ⅜ of 3 dollars, or 1 dollar	12½	cents.
200 miles, should be ⅜ of 2 dollars, or	75	„
300 miles, should be ⅜ of 1 dollar, or	37½	„
400 miles, 0	00	„

The difference between these sums and those above given constitutes the profits of the proprietors.

It cannot be objected to this scale of charges, that it deprives the citizen on the line, near the mart, of any of the advantages of his position. The work, on the contrary, furnishes him with the means of transporting the products of his estate to a market for one fourth or one fifth the sum he was compelled to expend before its construction. This is a positive advantage for which he is indebted to the commonwealth; and he has no right to complain if the same commonwealth extend the benefits of the enterprise to more distant citizens. The avowed object of the improvement is to bring to market productions which could not otherwise reach it, and, generally, to reduce the tax on transportation. And if the objection, that the mode of charging here recommended may seem to disturb the relative advantages of position of the near and distant denizen, be a valid one, it is *a fortiori* a conclusive argument against all improvement. A consequence of the construction of any canal or railroad, is to increase the value of estates to which it affords new facilities, and of course disturb the relation between the advantages possessed by such property and other estates in the commonwealth, on which it has no effect.

But such an objection, even if a legitimate one, cannot be applied to the scale here advised. It is not proposed to tax the distant man less for the transportation of his effects than the nearer one; on the contrary, he is charged more. The method merely proposes to make that portion of the tax which is to be considered as the profit of the State—that portion which is levied for revenue—proportional to the ability of the trade to pay it. And this is just.

Fig. 2.



If, now, we represent by a proper scale, as in Fig. 2, the area of the country which, with the data of this example, would furnish the tonnage, in the hypothesis of an uniform charge of one cent for freight and one cent for toll, we shall have, as before stated, a triangular figure N P N, with a base, N N, of 80 miles, and height, M P, of 200 miles.

But if the charges were adjusted with a view to the obtaining of the maximum revenue, the triangle would have a base, *n n*, of 50 miles, and a height, M R, of four hundred miles. In the one case the area of the country would be represented by the triangle N P N, and in the other by the triangle *n* R *n*.

But, instead of aiming to obtain the maximum revenue on all the trade which would reach the improvement from R to M, we may, by the system which it is intended to recommend, adopt in both instances an uniform charge for toll, as one cent per ton per mile, from M to M′—the point which corresponds with the intersection *n*′ of the sides of the superior and inferior triangles—and confine the arrangement made with a view to the maximum revenue, to that portion of the country situated between M′ and R.

The consequence of this arrangement would be to obtain the same tonnage and revenue from the country traversed by the portion M M′ of the line, in both cases, since the tariff would in that distance be common; and at the same time to increase the area of the country trading on the improvement, a quantity equal to the whole of the shaded space in the figure, and to increase the revenue a quantity equal to whatever would be due to this additional trade and the charge upon it, determined in accordance with the principles here laid down.

It will be perceived that the increase of tonnage and revenue which, in the first part of this article is shown to have place, will be obtained without any increase of toll on any part whatever of the trade. We have only to take the present tariff of New York or Pennsylvania, or any other state or company, and obtain these results by a reduction of the charges.

For, at the point P, which is supposed to be 200 miles from M, we have seen that a toll of one cent per ton per mile would entirely exclude the trade. But if, instead of a charge of one cent per ton per mile, at that point, or two dollars for the entire toll from P to M, the article were taxed but 75 cents per ton, as is stated to be the proper toll under the circumstances, there would remain out of the two dollars, which is the limit of the charge for toll it would bear at that position, a balance of one dollar 25 cents, to pay the expense of its transportation from *p* to P—a distance of 12½ miles on each side of the line. So that, by simply reducing the charge resulting from a tariff proportioned to the distance, we shall here obtain, instead of nothing, a revenue due to the tonnage that would be furnished by a district *p p*, 25 miles in breadth, at a charge of 75 cents per ton.

It is true that a much more important increase of revenue might be experienced by a modification of the uniform charge supposed to be levied from M to M′, and a reduction from the new tariff beyond M′. For, even where we to adopt the principle of fixing on a determinate toll per ton per mile for a certain distance, we should bear in mind that there is a certain uniform charge which will yield a higher result than any other. But, without any reference to this, or any of the other advantages which would be derived from a thorough and strict regard to the laws of trade in the establishment of the tariff, I have only sought to render clear the fact, that by simple reduction of the charges on a portion of the trade on all our public works, the revenue and tonnage may be simultaneously increased, and the tax on the public may be rendered more equitable.

EXPERIMENTS ON THE AMERICAN COTTON-GINS.

On Wednesday the 12th July, a deputation of the Board of Directors of the East India Company, paid a visit to Liverpool, for the purpose of witnessing a series of experiments in the cleaning of East India cotton by means of the saw-gins brought to England by Captain Bayles. The object of these experiments was two-fold: firstly, to show that by the introduction of the American saw-gin into India, the cotton of that country might be so well cleaned, and with so little injury to the staple, as to render it a marketable article to an almost unlimited extent; and, secondly, to ascertain which of the four gins was best calculated for the cleaning of Indian cotton, in order that other machines might be manufactured, either precisely on the same principle, or with such improvements as might seem desirable.

The experiments took place on Friday the 14th ult., on the premises of Messrs. Fawcett and Preston, where the gins had been fitted up, and steam-power applied to them. There were present the directors, deputations from the Glasgow and Manchester Chambers of Commerce, the Mayor of Liverpool, and a great number of extensive spinners, influential merchants and brokers, probably to the extent of 150 persons.

The Chairman ot the directors having explained briefly the objects of the Board, the experiments were commenced, under the superintendence of Captain Bayles, who was assisted by the four American planters remaining with him. A quantity of Surat cotton, in the state in which it had been gathered, and which had been two years in this country, was first exhibited to the company. It seemed to have been gathered when wet, and was very dirty; and the general opinion seemed to be that in its then state it was nearly, if not altogether, worthless. Twenty-one pounds of this cotton were put into each of the three American gins; No. 1, being the invention of Mr. E. Carver; No. 2, that of Mr. Jones; and No. 3, that of Mr. W. R. Brooks. Two of the gins have 60 saws; the other has 40; the time occupied in ginning therefore varied somewhat. Two, we believe, accomplished their work in about 9½ minutes; the third in about 11½.

The result of the experiment with the gin No. 3 was first tested; it was as follows:—cotton, 5 lbs. 3 oz.; seeds, 12 lbs. 8 oz.; waste, 2 lbs. 11 oz.; making within 10 oz. of the original quantity of 21 lbs. put into the machine. The yield of cotton, it will be seen, was one quarter. A sample was submitted to the inspection of the company generally, and they were requested to put upon it a value. Mr. Hardman Earle, Mr. Ashton, and another gentleman, were appointed special valuers. They decided that this sample was worth 4¾d. per lb.

Gin No. 2.—Cotton, 5 lbs.; seeds, 14 lbs. 10 oz.; waste, 12 oz. Value of sample, 4d.

Gin No. 1.—Cotton, 5 lbs. 5 oz.; seeds and waste, 15 lbs. 6 oz. Value, 4½d.

It is necessary to mention that the machines were not, as may well be imagined, in the best working order. This was especially the case with No. 2, between the saws of which numerous seeds had forced their way, thus injuring the staple more than would otherwise have been the case. The saws having been cleaned, a second experiment was made with this gin, the result of which was the production of a better cotton, valued at 4½d.

An experiment was then made upon the fourth saw-gin. This was also from America, but it was a machine of older date than the foregoing ones. Patterns of it had been made and sent out to each of the Presidencies, and the machines had been tried, but were pronounced to be a failure. They were in India worked with hand-power. Steam-power was employed in the present experiment; and 21 lbs. of the old Surat cotton was put into the gin. The time occupied in ginning this was 14½ minutes; but the comparative increase of time may in part be accounted for from the fact of the machine having a less number of saws. The result was—cotton, 4 lbs. 10 oz.; seed, 15 lbs.; waste, 10 oz. The cotton was well cleared of the seed and dirt, but the staple was very much cut. The estimated value was 4d.

As steam-engines are at present almost unknown in the interior of India, animal power will probably be employed, at least in the first instance, in the working of the gins. The above four are so constructed that either steam or animal power may be applied to them.

An experiment was now made on a hand-gin, constructed by Messrs. Fawcett and Preston, under the superintendence of Dr. Jones, who had only commenced the machine twelve days beforehand. The doctor stated that his great object had been to produce a machine which should possess the essential quality of standing the climate of India without warping. That, he thought, would do so; and he felt convinced that it would, with the substitution of properly finished saws, and the outlay of a little more time, turn out a good working gin. It has twenty-five saws, and may be worked with horse power. As, however, it was scarcely in a finished state, a regular experiment of its capabilities was not made. A small, but unspecified amount of the Surat cotton hitherto employed was put into the gin, so as to obtain samples. At first the result seemed unsuccessful. The cotton was said to be more cut than in any other instance; but, after closer inspection, the staple was allowed to be very fair, and the machine to have done its work well. A sample was compared with the others, and the cotton was pronounced to be equal to that produced by gins Nos. 2 and 4.

These were the most important experiments of the day, and were generally considered sufficient to prove that cotton of East Indian growth may be well cleaned by the saw-gin, without any very material injury to the staple. The establishment of this important fact will thus enable India once more to enter into competition with America as a producer of the raw material, and to occupy the place from which she was driven by the invention and general adoption of the saw-gin in America.

Improvements in obtaining power; patented by Moses Poole, Lincoln's Inn, July 7.—The intention consists in obtaining power by means of an apparatus, which has a series of blades or surfaces like flyers fixed in an oblique direction to an axis, which is made to revolve, and, consequently to carry them round at any velocity required, the atmosphere acting as the power of resistance, whereby a great power is obtained for propelling boats, carriages, &c. The inventor proposes to work this apparatus by means of an engine, which, if placed in a boat, carriage, or car of a balloon, the flyers or blades acting on the atmosphere will cause the machine to move in any direction required.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

INSTITUTION OF CIVIL ENGINEERS.

March 3.—The PRESIDENT in the Chair.

The following were balloted for and elected:—Robert Napier and Daniell Mackain, as Members; John Salkeld, Robert Batson, John Gandell, and Siegerick Christopher Kreeft, as Graduates.

"*Description of the 'Nonsuch' Iron Passage Boat plying on the Limerick navigation, between that place and Killaloe.*" By Charles Wye Williams, Assoc. Inst. C. E.

The attention of Mr. Williams having been attracted to the successful plan for the conveyance of passengers adopted on the Glasgow and Paisley Canal, where light sheet-iron boats of great length travel at a speed of nine miles an hour, he was induced to attempt the introduction of the same system on the Irish canals. A great difficulty, however, presented itself, as the locks there would only admit boats 60 feet long, which length was quite inadequate to the carrying out with advantage the principle involved in the long light Scotch boat. To overcome this difficulty, he constructed a sheet-iron boat, 80 feet long and 6 feet 6 inches wide at midships, having the stem and stern ends (each 10 feet long) attached by strong hinges to the body, and susceptible of being rapidly raised to a vertical position by means of winches, thus reducing the length to 60 feet when required to pass through a lock. It is evident that by this means there would be gained not merely the apparent additional buoyancy of 10 feet at each end of the boat, which, from the form, would not be very effective, but in reality the buoyancy due to an addition of 20 feet of the midship section. The boat thus constructed has been found to answer perfectly; the buoyancy is equal to that of the Scotch boats of similar dimensions; no crankness or unsteadiness accrues when the ends are raised; it is capable of carrying 60 passengers, travelling at a speed of 9 miles per hour, with the same power that was required to draw a 60 feet boat with a less load, and there is a much less action on the canal bank, in consequence of the increased length, which at the same time imparts stiffness, and enables passengers to enter and leave the boat with safety. Considerable time is saved in passing the locks, by the opposition of the square end when the bow is raised; the boat may thus be run almost at full speed into the lock, and both ends being raised simultaneously, it is stopped much more easily than if the tapered ends were down. No provision is necessary for keeping the ends down, as the weight of the bow and steersman answers the purpose.

This boat has been working without intermission for three years between Limerick and Killaloe, traversing twice daily a distance of 15 miles, on a navigation of considerable intricacy, and passing 11 locks, without any accident having hitherto occurred.

Mr. Parkes observed that, independent of the advantages of carrying more passengers, by continuing the midship section to the length of 60 feet, considerable speed was gained by the 80 feet boat, in consequence of its fine entrance and run. Mr. Williams informed him that the velocity was found to depend on the position of the boat on the wave; that the rider of the horses employed in towing the boat knew exactly the proper position of the wave with respect to the boat, and regulated the exertion of the horses accordingly—the velocity of the boat and the tractive force depending on the relative position of the boat and wave.

Mr. Field, in reply to some remarks respecting the effect of these rising ends on the buoyancy of the boat, stated that he did not understand it to be Mr. Williams's design to obtain additional buoyancy thereby. The ends only press on the water as much as is due to their own weight, and are principally useful in giving a fine entrance and run to the boat; thus having the whole space between the rising ends for the accommodation of passengers, and obtaining an absolute gain of the whole space that is lifted at each end, as in a boat of the ordinary length there must be the same tapering of the bow and stern ends. So great is the facility in managing the ends, that on quitting a lock the bow end is lowered as the gates are opening; the boat is set in motion at the same time, and as it moves on the stern end is let down, and the usual speed is obtained very soon after it clears the lock. When a lock is to be entered, the boat is suffered nearly to reach the gate at full speed, when the bow end being raised, the additional resistance caused by the square section being suddenly opposed to the water stops the boat almost immediately. The weight of one man at each end is amply sufficient to keep down the ends when the boat is in motion.

"*On the experiments and results of Mr. W. J. Henwood, as to the power of the Huel Towan Engine.*" By George Woods.

In this communication, the author refers to the experiments of Mr. Henwood, published in the second volume of the Transactions, and to the result there stated, that the curve traced by the pencil of the indicator during the expansion of the steam deviates from a true parabola, according to the temperature of the medium contained in the jacket. Mr. Woods comes to the conclusion that, the temperature remaining constant, the curve will deviate very considerably from a true parabola. The results obtained by the author as to the relative powers of the engine before and after the steam is cut off, and the mean pressure, as given by the indicator diagram, do not differ materially from those given by Mr. Henwood. But Mr. Woods differs from Mr. Henwood as to that portion of the curve which the latter selects as representing the true value of expansive working.

"*Description of a Running Gauge for ascertaining the Parallelism of a Railway.*" By Edward Cowper. (Described in the Journal, vol. ii, p. 245.)

"*An Azimuth Cap as an addition to the common Level.*" By Edward Cowper.

It is sometimes desirable in levelling operations to ascertain the bearing of objects which are either above or below the field of view of the telescope. The common level alone cannot take the bearing of such objects; for, by elevating or depressing the telescope, the action of the compass is destroyed; but, by slipping the azimuth cap on to the end of the telescope of the level, objects 50° above or below the field of view may be observed without disturbing the compass or altering the level of the telescope.

This instrument consists of a brass cap containing two slips of looking-glass placed at an angle to each other, precisely as in Hadley's quadrant; one glass being fixed at an angle to the axis of the telescope, and the other being moveable about a centre. When any object is required to be brought within the field of view, the cap is placed on the end of the telescope, and the angle of the moveable glass is varied until the object is reflected on the fixed glass, and thence to the eye.

March 10.—The PRESIDENT in the Chair.

The following were balloted for and elected:—John Manby, as a Graduate; Frederick John Evans, Richard Ravenhill, and John Clutton, as Associates.

"*A mode of bending Discs of Silvered Plate Glass into Concave or Convex Mirrors by means of the pressure of the Atmosphere.*" By James Nasmyth.

The difficulty of obtaining large specula for telescopes, together with the disadvantages attending the weight, the brittleness, and liability to oxidation, of the speculum metal generally used, induced Mr. Nasmyth to turn his attention to the employment of silvered plate glass for telescopic purposes, as it possesses perfect truth of surface, is lighter than metal, is not liable to oxidation, and a greater quantity of light is reflected from it than from any metallic surface.

To give a concave or convex form to a disc of plate glass, a certain pressure must be made to act equally over the surface. This equal pressure is obtained on Mr. Nasmyth's plan, by taking advantage of the weight of the atmosphere.

A disc of silvered plate glass, 39 inches in diameter and $\frac{3}{16}$ of an inch in thickness, is fitted and cemented into a shallow cast-iron dish, turned true on its face so as to render the chamber behind the glass perfectly air-tight; by means of a tube communicating with this chamber, any portion of air can be withdrawn or injected.

To produce a concave mirror so slight a power is required, that on applying the mouth to the tube and exhausting the chamber, the weight of the atmosphere, which amounts in this case to 3558 lb., acting with equal pressure over a surface of 1186 square inches, causes the glass to assume a concavity of nearly three-quarters of an inch, which, in a diameter of 39 inches, is far beyond what would ever be required for telescopic purposes. On readmitting the air, the glass immediately recovers its plane surface, and on forcing in air with the power of the lungs, it assumes a degree of convexity nearly equal to its former concavity. The degree of concavity or convexity may be regulated to the greatest nicety, and it is proposed to render the degree of concavity constant, by placing in the air tight chamber a disc of iron turned to the required form, and allowing the pressure of the atmosphere to retain the glass in the form given to it by its close contact with the iron disc. The curve naturally taken by the glass when under the pressure of the atmosphere is believed by Mr. Nasmyth to be the catenary, inasmuch as its section would be the same as that of a line suspended from each end, and loaded equally throughout its length.

Mr. Lowe did not feel well assured that the curve naturally taken by the "Pneumatic Mirror" was a catenarian, as the plate being set in a frame was supported all round its periphery, and resembled an arch resting on its abutments. He suggested the propriety of attempting to attain given curves by grinding the plate of different thicknesses in parts, so that the pressure of the atmosphere should affect it unequally.

Mr. Macneill was inclined to believe the curve assumed was the "Elastic Curve," the properties of which were examined by James Bernouilli, in the Memoirs of the Academy of Science, 1703.

March 17.—HENRY R. PALMER, V. P., in the Chair.

The following were balloted for and elected:—Theodore Budd and Thomas Steel, as Graduates; Geddes Pearce, William Lane, Thomas Jevons, and George Mills, as Associates.

"*An Account of the Performances of the Locomotive Engines on the London and Birmingham Railway during the year* 1839." By Edward Bury, M. Inst. C. E.

The engines used on the London and Birmingham Railway are all constructed on the same principle as to the main parts, the whole being upon four wheels, and only differing from each other in some of the minor details. The engines used for the conveyance of passengers have cylinders 12 inches diameter, with an 18 inch stroke; the driving wheels are 5 feet diameter, and the carrying wheels 4 feet diameter, The merchandize engines have cylinders 13 inches diameter, with an 18 inch stroke, and differ from the others in having all the wheels of 5 feet diameter and coupled together. The framing is of wrought iron, fixed inside the wheels for the greater convenience of connecting it with the boiler. The cylinders are attached to the frame by two strong wrought-iron bars passing beneath the lower semi-diameter, and secured by bolts to the ears cast on them. The cranks and fore axles are also fixed to the frame. By this arrangement, any concussion is received directly by that part of the machine best calculated to bear it, and when the force of the engine is exerted in either pushing or drawing, it is done directly through the line of the framing, and thus any strain is diverted from the boiler or from those parts of the machine liable to be injured. There are only two bearings on the axles, and they are inside the wheels. Any tendency towards depression in the centre from the weight would be counteracted by the continual upward pressure, arising from blows received by the flaunch of the wheels striking against the rails on curves, passing crossings, &c. The bushes which the axles run in are fitted into the frame in such a manner as to allow the springs to play vertically, but have flanches which prevent any tendency to lateral action beyond that necessary for the irregularities of the road, and they are of such a length as to enable them to hold up the engine in case of the breakage of one of the axles. It would appear that the breakage of the axles is a very rare occurrence, and that even when it has happened, the engines have performed the remainder of the journey and brought home the train with only a slight diminution of speed. The engines differ in weight according to the class they belong to. A passenger engine, with its coke and water in the fire-box and boiler, weighs 9 tons, 13 cwts. 1 qr.

	Tons.	cwts.	qrs.
The fore end	3	19	1
The after end	5	17	2

A merchandize engine, with coke and water, weighs 11 tons, 13 cwts. 1 qr.

	Tons.	cwts.	qrs.
The fore end	5	4	1
The after end	6	12	3

This form of engine was adopted by the author as early as the year 1829, when he constructed the "Liverpool," which was the original model engine with horizontal cylinders and cranked axles. It was set to work on the Liverpool and Manchester Railway in July. 1830. This form of engine has been invariably used on the London and Birmingham Railway since its opening.

The paper is accompanied by complete drawings of the engines, and tabular statements of their performances during the year 1839, showing the number of miles traversed by each engine, the weight conveyed, with the cost in detail of coke, oil, tools, wages, repairs, and general charges.

The performances of the engines extend over a distance of 700,000 miles, and a period of 12 months; and it appears that with the passenger engines,

For the first 6 months the average total cost of conveyance was . . .	$\frac{352}{1000}$	of a penny per ton per mile.
For the second 6 months the average total cost was	$\frac{280}{1000}$	ditto.
While with the merchandize engines—		
For the first 6 months the average total cost was	$\frac{203}{1000}$	ditto.
And for the second 6 months the average was	$\frac{227}{1000}$	ditto.

"*Earth Falls at the Undercliff in the Isle of Wight.*" By William Rickman.

The remarkable tract of coast called the "Undercliff" extends from the south point of the Isle of Wight, nine miles to the eastward. Its surface is distorted in form, somewhat resembling in miniature the volcanic features of Southern Italy; for although the latter has been formed by the action of fire, and the former by that of water, both have been moulded when in a state of partial fluidity. The soil is of a boggy nature, is intersected with numerous springs, and in it are imbedded, in the utmost confusion, detached masses of the weather-worn cliff-rock, forming in places natural terraces on the face of the cliff, and inclining inwards at different angles towards the land.

A sectional view taken through the south point, bearing north to the summit of St. Catherine's Down, would present these features.

From the sea beach of iron sand, strewed with shingle and boulders, rises a cliff of 60 feet, and from it a rugged and irregular ascent of 320 feet in height, half a mile in extent, composed of vegetable soil, chalk, green sandstone in masses and fragments, and of blue marle, the whole mingled indiscriminately and irrigated by numerous springs. Thus much constitutes the Undercliff. Above it appears the perpendicular, serrated profile of the Upper Cliff, 260 feet in height, from which the surface of the Down proceeds with a slight descent for a quarter of a mile, and then gradually rises in the extent of half a mile to a vertical height of 200 feet, being the highest land in the island—780 feet above the level of the sea. The strata are nearly horizontal, with a slight dip to the north-east. They are the upper part of the secondary or supermedial order, and consist of chalk, chalk-stone, green sandstone, blue marl, and iron or red sand.

This stratification would account for the subsidences of the Cliff which have occurred so repeatedly. The water collected by the extensive surface of the Down would percolate through the chalk and sand-stone beds until it reached the impervious blue marle, where it would accumulate until it finally escaped by oozing out over the edge of the stratum, carrying with it portions of the sandy subsoil; in this state it has the appearance of a slimy grit, consisting of particles of the sand-stone lubricated with clay; it is familiarly called "the blue slipper." A continuation of this infiltration for any length of time must end by undermining certain portions of the face of the Cliff, which, being unsupported beneath, detach themselves from the main rock and settle; the first settlement may not exceed a few inches, but a fissure having been formed the whole length behind the subsidence, the surface water pours into it, and continuing to moisten and undermine it, at length causes the slip to assume its present aspect. This soakage of water at the back of the mass may be supposed to sap its foundation at the rear and to give it the dip inwards, which is observed in all cases, and most evidently in such as are farthest advanced in their descent. A number of natural terraces are thus formed, and the process may be traced in every stage of its progress at different parts of the Cliff, as at Mirables, in the Pelham Walks, at Ventnor, and at the Luccombe landslip. These subsidences appear to have succeeded each other at long intervals of time, but there is no record of any so extensive as that which occurred in 1799, at which time upwards of 100 acres were set in motion. That the principal landslips took place prior to the Norman Conquest is proved by the existence of Bonchurch and St. Lawrence Chapel, which are supposed to have been built soon after the manor was surveyed for entry in Doomsday Book.

The President observed, that although papers of this kind did not appear to be exactly adapted for the meetings of the Institution of Civil Engineers, yet, as geology was so intimately connected with engineering, and it was always essential to ascertain accurately the nature of the ground where works were to be executed, such communications became not only acceptable, but very valuable, to the profession.

Mr. Lowe had paid much attention to a similar formation at Hastings, and while he agreed to the general correctness of the observations, he did not think a sufficient reason had been assigned for such a mass of iron sand with its incumbent chalk being driven seaward. He would attribute the subsidences at the Undercliff to the action of water percolating through the fissures into the thin beds of clay interspersed with lignites, with which the iron sand abounded. This, when moistened, would ooze out and permit the chalk to crush it outwards, causing the subsidences so ably described by Mr. Rickman.

March 24, 1840.—The PRESIDENT in the Chair.

The following were balloted for and elected:—Charles Lanyon, as a Member; Henry Addams, Thomas Macdougal Smith, and Robert Richardson, as Graduates; Henry Heathorn and Ardaseer Cursetjee, as Associates.

"*On the manufacture of Flint Glass.*" By Apsley Pellatt, Assoc. Inst. C. E.

Flint glass, called by the French "cristal," from its resemblance to real crystal, is composed of silex (whence the English name), to which is added carbonate of potash and litharge, or red lead; to which latter material is owing, not only its great specific gravity, but its superior lustre, its ductility, and power of refraction.

It is necessary for optical purposes that flint glass should be perfectly free from striæ, otherwise the rays of light passing through it diverge and become distorted, and this defect is caused by the want of homogeneity in the melted mass, occasioned by the difficulty of perfectly fusing substances of such different density as the materials employed. The materials, being properly prepared, are thrown at intervals into a crucible of Stourbridge clay, which will hold about 1600 lbs. weight of glass when fused. The mouth of the crucible is then covered with a double stopper, but not luted, to permit the escape of the moisture remaining in the materials, as well as the carbonic acid gas and excess of oxygen. It requires from 50 to 60 hours application of a rapid, intense, and equal heat to effect the perfect fusion of the materials and to drive off the gas; during which time the unfused particles and excess of salts are skimmed off as they rise to the surface. The progress of fusion cannot be watched, nor can any mechanical means for blending the material during fusion be resorted to, lest the intensity of heat requisite for the production of a perfectly homogeneous glass should be diminished, the quality of the product being influenced by any inattention on the part of the fireman, as well as by the state of the atmosphere or of the wind. It has been ascertained, that there is a certain point or crisis of fusion at which the melted metal must be kept to insure a glass fit for optical purposes, and even when that point be attained, and the crucible shall furnish proper glass during several hours, should there be such diminution of heat as to require the furnace to be closed, the remainder of the metal in the crucible becomes curdy and full of striæ, and thus unfit for use. It is the same with the glass made for the flat bore tubes for thermometers, which are never annealed, because the smoke of the annealing furnace would render the interior of the bore unfit for the reception of the mercury. These tubes will only bear the heat of the blow-pipe when they are made from a metal which has been produced under all the favourable circumstances before described. It is, therefore, to be inferred, that the most homogeneous and perfect flint glass can only be produced by exposure to an intense and equable degree of heat, and that any excess or diminution of that heat is injurious to its quality.

The English method of manufacturing the flint *plate* for optical purposes is thus described. About 7 lb. weight of the metal is taken in a ladle of a conical shape from the pot at the proper point of fusion, and then blown into a hollow cylinder, cut open, and flattened into a sheet of glass of about 14 inches by 20, and varying in thickness from $\frac{3}{8}$ to $\frac{1}{4}$ of an inch. This plate is afterwards annealed, and in this state goes into the hands of the optician, who cuts and grinds it into the requisite form. When a glass furnace is about to be put out, whole pots of metal are sometimes suffered to remain in it, and cool gradually. The crucibles being destroyed, pieces of glass may be cloven from the mass of metal, softened by heat, and made to assume the requisite form, and then ground. It is believed that the excellent glasses made by Frauenhoffer, and other manufacturers on the continent, are produced by some such means. On attempting to cut glass ware, it is easily perceived if it be sufficiently annealed; if not, the ware is put into tepid water, which is heated, and kept at the boiling point during several hours; it is then suffered to become gradually cold. This method is more efficacious than re-annealing by the ordinary means. A piece of unannealed barometer tube of 40 inches in length being heated and quickly cooled, contracted only $\frac{1}{16}$ of an inch, whereas a similar piece, annealed by the usual means, contracted nearly $\frac{1}{8}$ of an inch. Unannealed flint glass, being heated and suddenly cooled in water, exhibits the appearance of a mass of crystals; it is thence inferred that the process of annealing renders the glass more compact and solid; it thus becomes incapable of polarization.

Flint glass being remarkably elastic, has caused it to be used for chronometers. To prove its elasticity, a hollow ball of unannealed glass of 3 inches diameter, weighing about 16 ounces, was dropped, when cold, from a height of 7 feet upon a stone floor; it rebounded uninjured about 3½ feet, but broke on falling to the ground after the rebound. Similar balls, both at a bright and a low red heat, were dropped from the same height, and both broke immediately without any rebound; thus demonstrating that its elasticity only exists while cold. Glass being sometimes deteriorated in the process of reheating, not only in colour, but in its faculty of welding, by the sulphur existing in the coal or coke used in the furnace, this is prevented by occasionally throwing about a quart of cold water on the fire; the explosive vapour thus raised carries off the sulphureous gas.

The process of annealing has the remarkable property of carrying off from the glass the reddish tint imparted to it by manganese; and in large masses, not only the reddish tint disappears, but the glass sometimes becomes green or blue, probably by the action of the sulphureous acid gas from the coke. The reddish tint will however return, and the greenish one disappear, should the annealed glass be afterwards heated or remelted. Should the pot crack during fusion, and the flame or smoke come in contact with the melted metal, a green tint and abundance of dense striæ will be the consequence. Such an accident can only be repaired, if the crack be accessible, by throwing cold water on the exuding metal, which thus becomes gradually cooled, and itself forms a lute, so as to enable the process of melting to be continued. Long experience has shown that the best fuel for melting glass in the furnaces is oven-burnt coke mixed with a small quantity of screened coal.

Mr. Pellatt illustrated the preceding paper by specimens of glass exhibiting peculiar effects of crystallization; among them were cylindrical solid pieces of flint glass, which, from being suddenly cooled by plunging them into water, had the interior entirely dislocated, and were merely held together by the exterior coating; portions of tubes showing the same effect; a portion of a vase of white glass dipped into blue glass of a greater density—in cooling, the interior white glass appeared to be crushed by the contraction of the exterior coating; a similar vase of white and blue glass of more equal density had cooled, and bore cutting without cracking; a mass of optical glass, exhibiting striæ, specks, and imperfections; which, together with the modes of manufacture, he explained.

In answer to several questions, Mr. Pellatt was not aware of any attempt having been made to cut the bulb of Prince Rupert's drops: he believed the perculiar property of the bursting of these drops or tears, on the end being broken, arose from a crack suddenly commencing and extending itself rapidly throughout the mass, causing the dislocation of the particles. Flint glass is seldom sufficiently fluid to make these drops; they are generally made from glass which does not contain lead.

Alluding to the use of plate glass in Nasmyth's Pneumatic Mirror, he observed that, owing to the absence of lead, plate glass was purer and more homogeneous than flint glass, and the equality of thickness produced by grinding and polishing enabled the curve caused by the pressure of the atmosphere to be very regular.

The use of coke as a fuel, by the regularity of its combustion, assists materially in producing good results, and prevents the injury which frequently arises from a difference in the heating powers of various coals: unfortunately, the form of the furnaces causes the greatest heat to be in the centre, thus acting most powerfully upon the backs of the pots, instead of being equally distributed around them, which would be more desirable and would insure better results.

Mr. Pellatt still continued to use nine parts of coke mingled with one part of small coal in preference to any other fuel. He had abandoned the use of gas coke, and now purchased small coal at a low price, which he converted into a moderately-hard coke, rather less dense than that used for smelting iron. In the north of England, a charge of coal generally remained in the oven during 48 hours; in London, only 36 hours; he made lighter charges and coked them in 24 hours. He still found the calorific effect of 8 or 9 lb. of coke to be equal to that of 12 lb. of coal; in his ovens, 20 cwt. of coal produced 14 cwt. of coke.

Mr. Parkes inquired, which was the best method of annealing tubes for water gauges on boilers? He generally used those prepared by Mr. Adie, of Liverpool, who annealed them by placing them in cold water and gradually raising the temperature to the boiling point, at which it was kept for 24 hours; yet, in spite of these precautions, which generally were successful, he had seen twelve of these tubes break in one day, while an apparently ill-made tube had lasted six weeks. He found thin tubes last longer than thick ones. He was in the habit of removing the stains of bog water from his boiler gauges by scouring them with emery; when reheated, they invariably broke; after many experiments, he tried the use of acid, which answered perfectly, and no tubes were subsequently broken.

Mr. Pellatt recommended boiling as a safe and good mode of annealing all kinds of glass; in the ordinary method of annealing, thick and thin ware is often subjected to the same process, and remains in the leet for the same period: this would account for the superior duration of the thin tubes. He attributed the fracture of the tubes to the tension of the exterior coating and the vibration caused by the process of cleaning: this effect was so well known that old tube could scarcely be sold, as it generally broke in cleaning.

Mr. Hawkins observed, that tubes almost invariably broke in merely removing dust from the inside, whether it was done by rubbing with a tight packing or by slightly wiping it out. In some experiments on the production of carbonic acid gas, he used glass tubes of ¾ of an inch internal diameter and ¼ of an inch thick: they bore a pressure of 100 atmospheres. Some wrought-iron tubes into which holes of ¼ of an inch diameter were drilled and pieces of glass inserted, bore a pressure of 600 atmospheres.

REVIEWS.

Papers on Iron and Steel, Practical and Experimental. By DAVID MUSHET. London: John Weale, 1840.

IN the volume before us we have the result of Mr. Mushet's labours for the last 40 years and upwards, on the investigation of the properties of iron. Most of the papers have appeared in the Philosophical Magazine, the first as long ago as 1798, they are now collected together in one volume with additional notes and remarks, occasioned by the new discoveries since the period of their first publication.

It must be most gratifying to Mr. Mushet to reprint the precept at the commencement of the present volume, which was also the prelude of the first paper which appeared in public, and one which we are sure every scientific man will read with pleasure.

> It is much to be wished, that men practically versed in the various manufactures of Britain would turn their attention to the best means of disseminating a knowledge of the principles and operations which have been determined by experience as the best to be followed in the large way, according to local and other circumstances. A candid and liberal communication of individual observation, by promoting the common interest, would tend ultimately to the benefit of each manufacturer, by the increased improvement and perfection of their various articles; for the real welfare of any particular branch depends less upon the superiority of one man's article over that of another, in the same line, than upon the general superiority of a national product over that of any other country—a pre-eminence that depends entirely on the aggregate mass of industry, ingenuity and intellect exerted in the one or the other.
>
> What I recommend is the more necessary, as inaccurate and fallacious principles are often brought forward by men of science, even the best intentioned, from a want of that practical knowledge, which can only be acquired by a long and personal acquaintance with the processes carried on in the large way of manufacture. The mischiefs hence occasioned are incredible: it tends to separate the man of science and the manufacturer; it shackles the latter with increasing prejudice; makes him view the former with a suspicious eye; is the principal reason why science has been so long excluded from our manufactories; and why the accurate results of the laboratory have so long been despised by the practical artist, and been deemed undeserving of experiment on an extended scale. The artist and the man of science should mutually inform each other: principles will then, and not till then, acquire consistence and correctness, and their value will be established on the surest foundation.

The volume before us as we have stated is not a mere reprint or collection of the original papers, but contains in addition the results of Mr. Mushet's subsequent experience, thus forming a complete and uniform work. Although confined only to one branch, that of the manufacture of pig iron, and the description of the ores and fuel necessary for producing it, it gives in a volume of 952 pages a mass of information, which is invaluable to the manufacturer and the student. It is to be hoped, however, that should this volume meet with the success, which it cannot fail to attain, if it be rewarded according to its merits, that Mr. Mushet may be induced to give a second volume, as he intimates, on malleable iron and steel, and possibly a third volume on the subject of some of the other metals. We feel certain that Mr Mushet need not delay on this account, but that in full anticipation of a successful reception, he may go on confidently to render fresh services to the public, and add new honours to those he has already received. Mr. Mushet has done much himself, but he has done more in showing how much it is in the power of an individual, by his own exertions, to benefit his fellowmen, and increase the resources of his native land. To those who know Mr. Mushet no enumeration of his labours is necessary, but those who do not cannot do better than peruse the narrative given in the preface to the present work, from which we extract that portion relating to the grand discovery, by which he conferred such a boon on Scotland and the iron trade in general.

> Notwithstanding these early reproaches, I have lived to see the nomenclature of my youth furnish a vocabulary of terms in the art of iron making which is used by many of the iron masters of the present day, with freedom and effect, in communicating with each other on the subject of their respective manufactures.
>
> Prejudices seldom outlive the generation to which they belong, when opposed by a more rational system of explanation. In this respect, indeed, "Time," as my Lord Bacon says, "is the greatest of all innovators."
>
> In a similar manner has Time operated in my favour, in respect to the Black-band iron-stone. The discovery of this was made in 1801, when I was engaged in erecting for myself and partners the Calder Iron Works. Great prejudice was excited against me by the iron masters and others of that day in presuming to class the *wild* coals of the country with iron-stones fit and proper for the blast-furnace. Yet that discovery has elevated Scotland to a considerable rank amongst the iron making nations of Europe—with resources still in store that may be considered inexhaustible.
>
> But such are the consolatory effects of time, that the discoverer of 1801 is no longer considered the intrusive visionary of the laboratory, but the acknowledged benefactor of his country at large, and particularly of an extensive class of coal and mine proprietors and iron masters, who have derived, and are still deriving, great wealth from this important discovery; and who, in the spirit of grateful acknowledgment, have pronounced it worthy of a crown of gold, or a monumental record upon the spot where the discovery was first made.*
>
> At an advanced period of life, such considerations are soothing and satisfactory. Many under similar circumstances have not, in their own life-time, had that measure of justice awarded to them by their country, to which they were equally entitled. I accept it, however, as a boon justly due to me, and as an equivalent in some degree for that laborious course of investigation which I had prescribed for myself, and which, in early life, was carried on under circumstances of personal exposure and inconvenience, which nothing but a frame of iron could have supported. They atone also, in part for that disappointment sustained in early life by the speculative habits of one partner, and the constitutional nervousness of another, which eventually occasioned my separation from the Calder Iron Works, and lost me the possession of extensive tracts of the Black-band iron-stone, which I had secured while the value of the discovery was appreciated only by myself.

How gratifying must it be to Mr. Mushet to look back and contemplate these labours of his pen, which have been received by the public with so much interest. We are unable now to enter into an examination of the very many papers which the work contains, but we can assure those of our readers who desire information on this important department of our national wealth and strength, that they will find it the most valuable work on that subject yet published, one which we are sure must find its way into every scientific library throughout the world. We shall not suffer Mr. Mushet's work to escape us without another notice.

---

* From the Airdrie estate last year, from Black-band iron-stone alone, Sir W. Alexander derived a clear income of £16,500.

A Treatise on Engineering Field Work. By PETER BRUFF, C. E. London: Simpkin, Marshall, & Co. 1840.

We noticed at some length, in the first volume of the Journal, the first edition of this work, which, we are happy to find, has arrived at a second edition with considerable additions. It contains a great deal of real practical information for the student, and even to the old practitioner it will be valuable, who will find many hints dispersed throughout the work well worth knowing. We perceive that the present volume is entirely confined to land surveying, and that the division on levelling will appear hereafter in a distinct volume. It is our intention to turn to this volume next month, when we shall give a few extracts; in the mean time, we have much pleasure in recommending the work to all those who wish to become acquainted with land surveying.

A Brief Survey of Physical and Fossil Geology. By FREDERICK JOHN FRANCIS. London: Hatchard, 1839.

THIS small work is a republication of two lectures delivered at Literary Institutions, and therefore well adapted for popular circulation. The object of such a performance almost places it out of the range of criticism, particularly, whereas in this instance, the work seems carefully compiled.

STONE CHURCH.

W. WILKINSON, DEL.

Illustrations of Stone Church, Kent, with an Historical Account. By EDWARD CRESY, F.S.A. Published for the Topographical Society, Trafalgar Square. London: H. Hooper, 1840.

THAT an active society formed of competent members, having for its object the making known those specimens of architectural, and sculptured antiquities, which from their remoteness from the capital, or other adventitious circumstances, are liable to be overlooked by the mass of observers, and thus exposed to neglect, was felt to be a great desideratum, no intelligent Englishman will deny; and to such a one it must be a subject of congratulation, that a task so replete with difficulties, and requiring so much sound knowledge, and varied talent on the part of those who engage in it, should have become the province of a topographical society, whose members possess the valuable acquirements displayed in their beautiful publication of "Stone Church."

Nothing that we can say can possibly enhance the merits of this charming volume; and in speaking of it in the highest terms of praise, we are guided by no other motive than that of indulging a feeling of gratitude, towards a society which shews such devotion, to a cause in which we, in common with all sincere lovers of art and their country, feel the deepest interest.

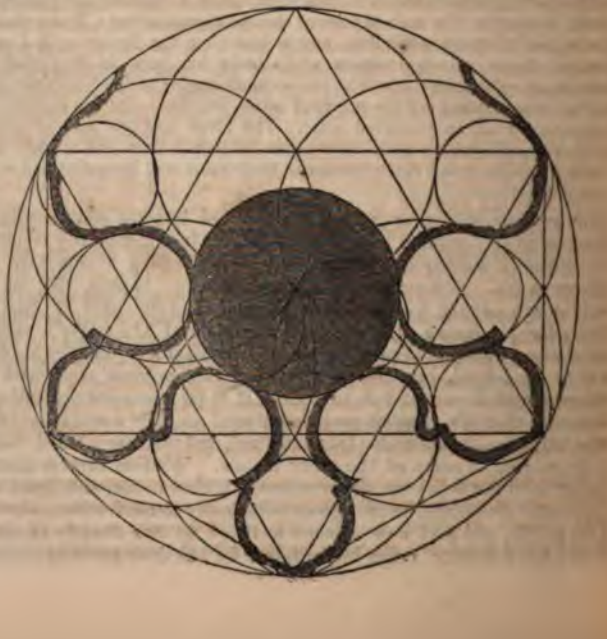
The creating among the masses an intelligent admiration of the monuments which adorn their country, has the happy effect of binding the former more and more to the land of their birth, and becomes a sure means of fostering and promoting that noble feeling, love of country; and we know of no subject more worthy of the civilized state in which we live, than that of rescuing from oblivion and decay, the numerous unpretending, but beautiful structures, left us by our ancestors, which, whilst they have thrown an irresistible charm over our country, have also given birth to that taste for the beautiful, in the exercise of which at various periods of her history, England has reaped so many unfading laurels.

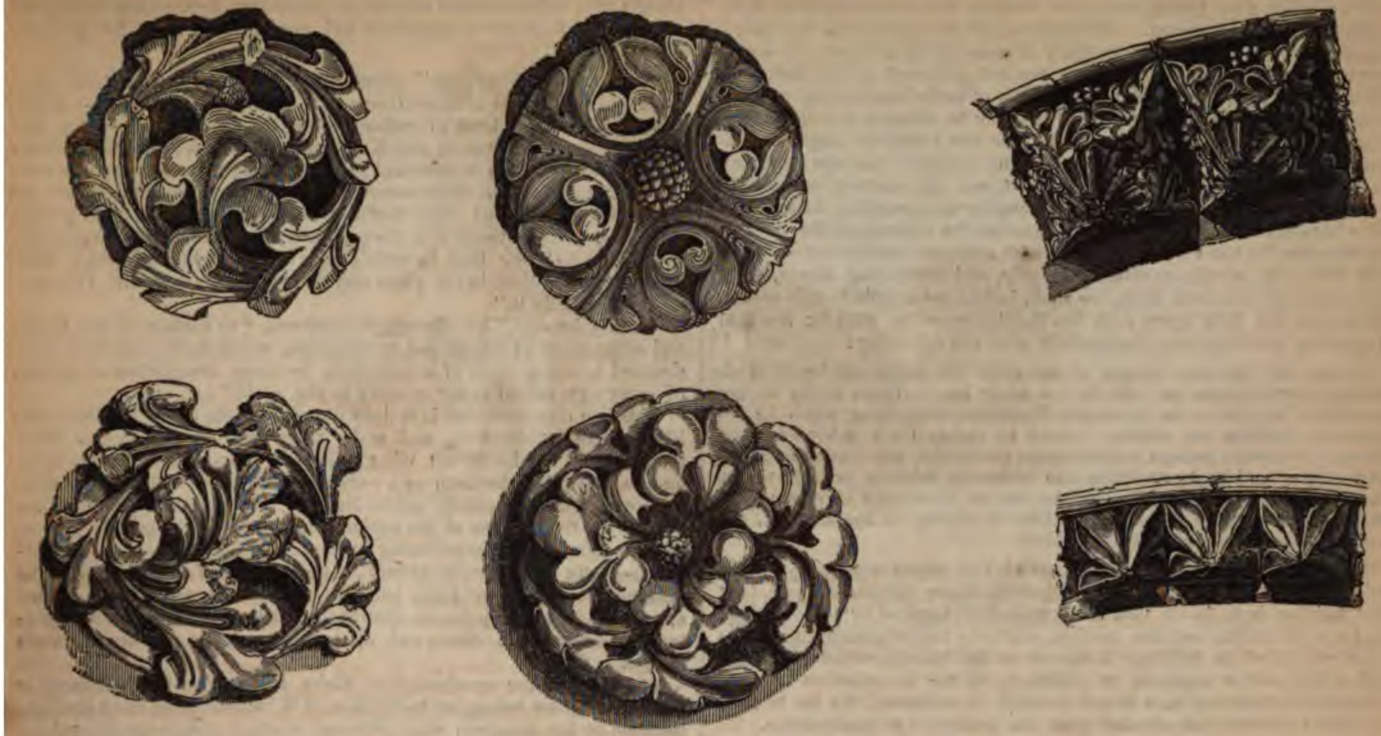
The means which it is clear the members of the topographical society possess of honourably compassing their laudable object, will we trust, insure them the willing co-operation of those who simpathising with the subject, are fortunate enough to have the power of exerting themselves usefully in a sphere yielding so much personal entertainment as well as benefit to the public, for be it remembered that the revival of that which is old and good, far from being of a merely retrospective character, has in it an active principle, that of kindling a generous emulation in the minds of the present generation, and that at no period of our history has this stimulus to mental exertion been more required than at the present, when throughout the country we find coupled with great zeal for building ecclesiastical edifices, a reckless indifference to taste, a fitness of character, degrading to our religion as well as to art.

In selecting Stone Church for publication, the society have chosen a subject well calculated to exercise the taste and antiquarian knowledge of its members. It is an elegant building, most carefully designed and executed in that pure style, which was the offspring of the 13th century, and associated with it are many interesting historical details, all of which is most clearly and scientifically set forth in the work before us; connoisseurs are unanimous in their opinion of the merits of this interesting structure, and recognise in it the standard of taste in the beautiful style in which it is designed, there being nothing to be found, not even in our cathedrals, to transcend the fine style, and masterly execution of the ornaments; this building offers a peculiarity in its system of internal decoration, viz., that of the ornaments gradually assuming a richer character as they are placed nearer the altar, this arrangement, whether the result of some fortuitous circumstance, or the original intention of the architect, is so pleasing, as to be quite worthy of imitation.

The following passage shows upon what severe principles these decorative accessories are composed, and we quote this passage the more willingly, because it advocates that important principle, the knowledge of geometry, which we believe to be the true foundation of excellence in architecture, and because it has long been our conviction, that a no more sure method could be adopted of upholding amongst us a fine taste in that sublime art, than that of an assiduous cultivation of the science of geometry, in schools destined for the education of architects; whose motto, over the threshold of their studios should ever be, "Nemo geometriæ expers, huc ingrediatur."

"Salisbury, Lincoln, Westminster, Winchester, and other buildings of this time, no longer exhibited the round arch or features borrowed by the Normans from Roman constructions, but a new style altogether, having principles essentially geometrical; and it is in vain that we attempt to imitate the tracery or mouldings belonging to this style correctly, unless we consider them to emanate from some simple figure. However numerous the mouldings, they never appear confused, which entirely arises from the order observed in their arrangement; this may be better expressed by the subjoined diagram, taken from the





BOSSES AND ENRICHMENTS FROM THE CHANCEL.

mouldings which form the trefoil arches round the chancel of Stone Church. The points of intersection of the two equilateral triangles are the centres for the hollows, and the more prominent parts of the moulding are set out with the same radius at the points of the triangles; or, in other words, four circles are encircled within a circle, and by omitting each alternate one the figure is formed. From the equilateral triangle are readily produced the hexagon and duodecagon; and the rose windows of the churches and cathedrals of France, many nearly fifty feet in diameter, and exhibiting a great varity of figures in their designs, are among the most beautiful examples which can be cited of the early and later application of the equilateral triangle to the figures of architecture. From the trefoil, sexfoil and their multiples, as shewn at St. Denis, proceeded the flowing tracery, simply produced by omission of portions of the regular geometrical figure, that which remained being so combined that the manner of its setting out was concealed, probably for the purpose of exciting wonder in the spectator, and thereby adding to that air of mystery which the craft delighted to spread around them. The system depending on the equilateral triangle for its variety of form continued in use till the beginning of 15th century in France, when it underwent a great and important change by the introduction of the isosceles triangle, and its compound the pentagon. A pupil of Alexander de Berneval, architect to the church of St. Ouon at Rouen, proved that these figures could furnish novelties in design, and that all beauty was not confined to the long used favourite triangle.

"To the common observer this theory may appear fanciful, but the writer does not hesitate to assert that the boldest mouldings, and the most delicate tracery, where gently flowing lines seem the result of a sportive fancy only, equally emanate from the same sources, and that it is to the neglect of the application of the rules of geometry that we may attribute the defects and failures wherever an imitation of this early style has been attempted in the present day, which neglect has been greatly fostered by the too prevailing opinion that all the beauty we admire is produced by art alone unaided by the science of geometry, the time devoted to line and rule being considered lost. The beautiful tracery, called by some *par excellence*, the decorated English, cannot accurately be displayed without a knowledge of these principles. Many examples have been tested to prove this fact."

In this building we also find an instance of the comprehensive view which our ancestors took of architecture, in common with other bygone nations excelling in that art, painting—not restricted to the stained glass window—entering largely into the composition.

The principle of combining painting with architecture appears to have been upheld at all periods signalized for devotion to the latter art, and that whatever be the styles which have arisen, their authors seem to have participated in the feeling that a building erected for some dignified purpose, however carefully designed and executed, might be its architectural features, would fail to fulfil its object, if it lacked the charm of color, considering the true province of architecture to be the medium of gracefully uniting the sister arts of painting and sculpture.

"Polychromy was introduced into our churches at a very early period, and became the general decoration where magnificence was aimed at, and the more costly substitute of mosaic could not be obtained. The Greek temples in the days of Pericles even had their pure white marble painted and gilt, and traces of it may still be found in the frieze of the admired Parthenon. The Egyptian as well as the Roman buildings at a very early as well as later period were all painted; and the practice seems only to have been lost in this country after the Reformation."

Until lately we believe there existed some doubt as to whether the authors of the Gothic style indulged in the art of polycromy, that they cultivated this fascinating art willingly, is however now certain—and were consequently not partial to that gloomy aspect which many of their buildings assume, when denuded of the brilliancy of their colours, introduced no doubt for the express purpose of counteracting that sombre effect incident from either the nature of the design itself or its inclosed situation. Thus the cloisters of Westminster Abbey now so repulsively gloomy, must have been most attractive when exhibiting, as they once did, all the pomp of colour. It is impossible to take leave of this subject without offering our sincere congratulations to the topographic society upon the success of their efforts, and expressing our conviction that all lovers of art will acknowledge their present volume of Stone Church to be a valuable contribution to the store of literature and art. The manner in which the work is executed deserves the highest commendation, the plates exhibiting great delicacy as well as vigour,

---

Specifications for Practical Architecture. By ALFRED BARTHOLOMEW, Architect. London: John Williams, 1840.

Mr. Bartholomew has produced a very valuable work, containing a vast accumulation of materials connected with the construction of buildings; he has condensed in a moderate size octavo volume a larger quantity of practical information than will be found in any other work of a similar description, we have besides 160 illustrations by wood cuts of the first character. Although we do not agree with the author in many of his remarks, particularly in some of his strictures on architecture and the use of cement, we are not disposed to find fault with him on that account, as the great variety of useful instruction which is conveyed by the many precepts, if we may be allowed to call them so, contained in this work, far outweigh the few faults we might be disposed to look into. Both professions, the architect and the engineer, will read this work with much interest, and the student by a careful study and perusal of it, will gain considerable *practical* knowledge. We have not time now to minutely examine the contents of the volume, as they are far too voluminous for us to attempt hastily, but we shall not fail, next month, examining largely, and extracting freely, from the pages of this text book, we shall, before we conclude this notice, state that we fully agree with Mr. Bartholomew in what he has said regarding specifications, particularly with the following:

> Except for the mere *manner* of the work, the author can hardly think strong general clauses just; and he now never inserts them, unless he has previously included in the *particular description*, every thing which he believes the building can require: indeed he cannot think it borders upon honesty, to involve perhaps in bankruptcy, the builder, who like all labourers is worthy of his hire, by rendering him ignorantly liable to perform, to the detriment of his family and his creditors, and to the scandal of society, that work, of the nature of which, at the time of signing of the contract, the architect himself has not had a clear idea.

We have more than once, denounced the unjust sweeping clauses which are frequently inserted into specifications, particularly one, that the builder is to do all that is expressed or implied by the drawings and specifications, and also another, whereby the responsibility of the construction of the building is thrown on the builder, which is strictly belonging to the engineer or architect, by the introduction of such clauses, it allows any man to call himself an architect, for he is thus enabled to escape censure and cloak his ignorance of construction.

Architectural Remains of the Reigns of Elizabeth and James I.

As a series of historical documents, illustrating the architecture of the period referred to, and also as contributions towards topographical information, these drawings possess considerable interest, apart from the pictorial merit of several of them. Still, we must be allowed to question the propriety of taking examples of that period as models suitable for imitation, at the present day. To revert to a style of the art that was in itself merely an attempt towards one, it being superseded by another before it had time to develop itself, to get rid of its crudities, to become refined as well as matured, appears to us a rather backward, crab-like advance, and not very much less absurd than it would be for an adult to imitate the tottering steps of a child just learning to walk. There might be something like sense in going back to any *Renaissance* style for the purpose of taking it up where it had been abandoned, and applying to it those lessons in taste which we have—or ought, by this time, to have—acquired from what has since been produced or been studied. Could we, by some architectural chemistry, extract all the good qualities of the Elizabethan style, leaving all its dross and impurities behind;—could we transfer to modern designs its stateliness, its picturesque combinations and outlines, its freedom and spirit, without any of its barbarisms and deformities, without any of its uncouthness and extravagance, its puerile conceits and incongruities, without its inconsistent mixture of overdone finery in one part and poverty in another, could we accomplish this, or were we to attempt it, there would be some plausible pretext for taking the style so far into favour again. But to adopt it, as we find it to be when adopted at all, with all its vices, is surely somewhat preposterous. At present it is imitated without any discrimination; we either find it copied in all its rude and unmeaning, yet most expensive finery, or, if attempted to be simplified, reduced to naked deformity and insipid monotonousness, and deprived of all that tends to render it if extravagant, at least picturesque.

However, there is no occasion for our deprecating the imitation—the *literal imitation*, we mean, of Elizabethan architecture any further, because, we conceive, its day, as a fashion of the day, is nearly over. The recent application of it to shop fronts is likely to open people's eyes to its *vulgarity*, far sooner than all the objections of criticism. Besides which, it has lately received some tolerably staggering blows from criticism itself. Mr. Wightwick—and his book is likely enough to find its way into fashionable circles—speaks of Elizabethan as "beneath abhorring" as a style, though deserving notice as a link in the history of the art; which opinion will doubtless cause some of its fashionable admirers to stand quite aghast. Mr. Bartholomew, again, speaks of it without more respect or ceremony, denouncing it in good set terms as founded in ignorance and corruption. Nay, he goes so far as to say,

"Among the numerous" (*quære*) "architectural publications that issue from the press in these times with such rapidity, may be mentioned those which treat of buildings erected in England during the reigns of Queen Elizabeth and King James the First; but while these works, some of them so splendid in their embellishments, are so valuable as furnishing historical records, yet is it to be regretted that no works ever published ever had a more pernicious effect upon public taste; for some of those who view their embellishments feel a strange inclination to copy that in which their eye delights, although they know its corruption, in the same way as children look at dirt till they desire to handle it."

"It may be said," he afterwards observes, "to contain all the faults and corruptions of design and composition, which have ever been condemned in every style of architecture by every description of critics, of every age, and of every country in the world"!

This is a clincher! and if it does not put people out of conceit with Elizabethan architecture, and make them heartily ashamed of their fancy for it, we know not what will. Of course Bartholomew must look upon Mr. Richardson as a very great offender, one of those who have contributed to vitiate public taste by their splendid publications. To say the truth, some of the subjects contained in the part before us, are so seductive and captivating as pictures, as almost to disarm criticism;—little is it to be wondered at, therefore, if those are apt to be mislead, and have their fancy led captive by them, who either cannot or will not be at the pains to discriminate between the charm of pictorial treatment and effect, and what belongs merely to architectural design.

The view of the quadrangle at Kirby, the seat of Lord Chancellor Hatton, and now belonging to the Earl of Winchelsea, affords a striking instance to the purpose; since although a singular *mélange* as to style,—although the entrance tower and porch present a mere grotesque parody of Roman architecture, and although large fluted pilasters of the Ionic order appear in other parts between lofty and spacious windows and bays, whose openings are divided into a system of small panels, by numerous mullions and transoms,—the general effect is so imposing, picturesque, and even scenic, that we admire almost in spite of ourselves. Still we should not admire the less, were some of the mere extravagances expunged or abated. However this building—or at least a portion of it, for if not altogether so grotesque, the Garden Front is by no means so "*exciting*," is of superior quality to the generality of Elizabethan designs.

The Garden Porch at Coombe Abbey, opening upon a terrace with a rich open work parapet, is another picturesque bit, though a mere bit, of architecture; but it shows exceedingly well in the drawing, because it is given on a satisfactory scale, and the subject is confined to it. On the same plate is another drawing representing part of the Great Chamber and its fireplace, at Coombe; but although we are well satisfied with it as a picture, we have no admiration to bestow on the subject itself, for nothing can be more barbarous and uncouth, more perversely hideous in taste, than the whole of the chimney piece; however, there is very little danger of its being copied, at least not by any one who has not a terribly heavy purse, and is distressed how to lighten it.

Of that celebrated mansion Burghley House, we have here two views of the North and West Fronts, but we also desiderate a ground plan, and one, if not more elevations, notwithstanding that the character of the detail can be tolerably well made out in the perspective drawings, which show the building from a near point of view. In its general style this edifice is rather plain, and derives its air of magnificence and richness chiefly from its magnitude, and from the variety produced by its being broken into numerous parts, yet so as not to interfere too much with regularity, or with breadth of character. What decoration there is, is almost entirely confined to the summit of the structure, where the open parapets, turrets, domes and chimneys, make a "brave show." The chimney stacks, however, composed of two or more Doric columns, with a piece of entablature above them, are offensive conceits, and tend to suggest the idea of there having been originally some upper structure, of which they are the remaining fragments. Some of the parts of the parapets and their ornaments are shown at large in one of the Plates of Details, of which several are here given.

How far these latter will be found serviceable as practical studies, we pretend not to say, being inclined to suspect that the taste for the style itself, of which it may truly be affirmed that it is *vitiis imitabile*, will wear away as quickly as it arose.

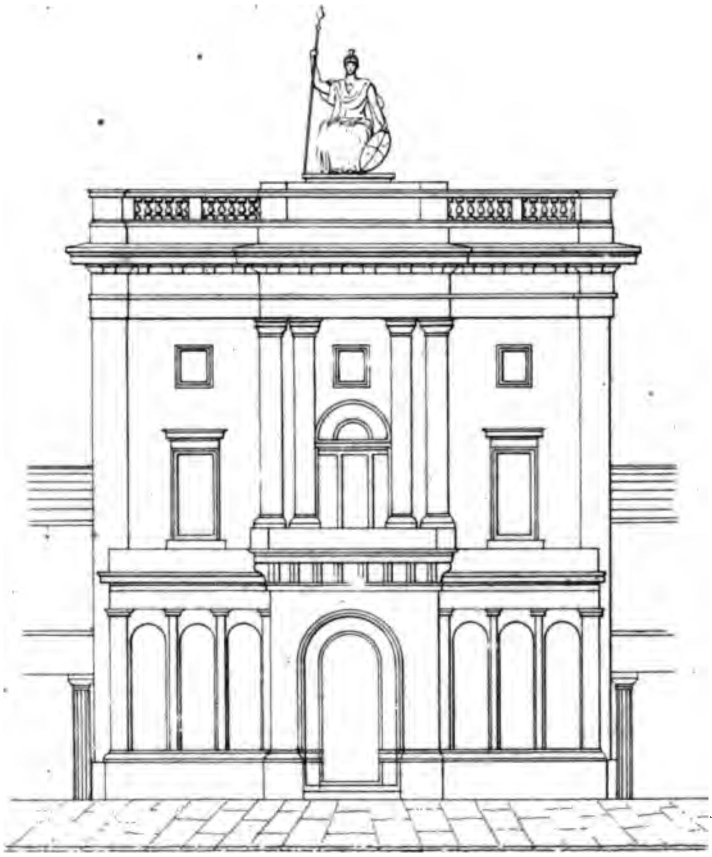
PLATE XV.

The Polytechnic Institution, Regent Street.

Depth 320 Ft

Height 40 Ft

Width 44 Ft



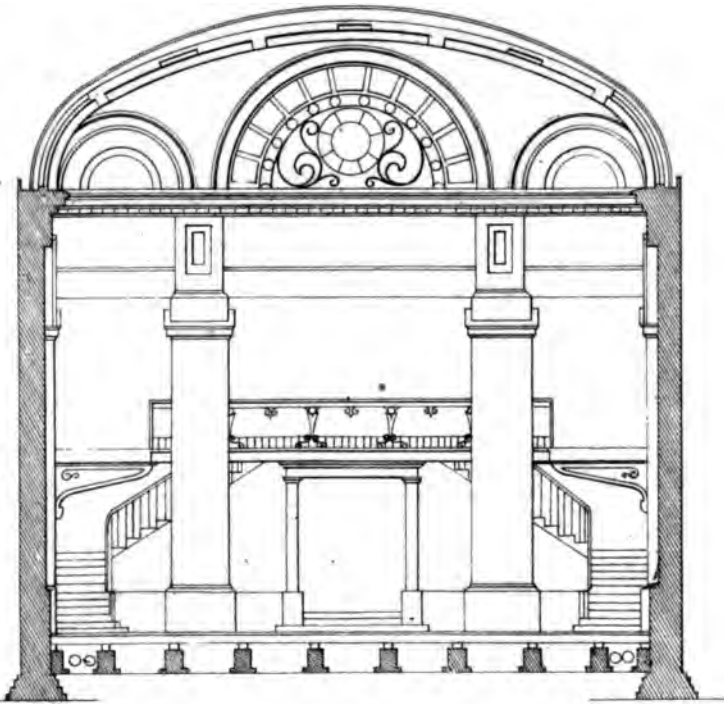
ELEVATION.

TRANSVERSE SECTION OF THE GREAT GALLERY

Length 120 Ft

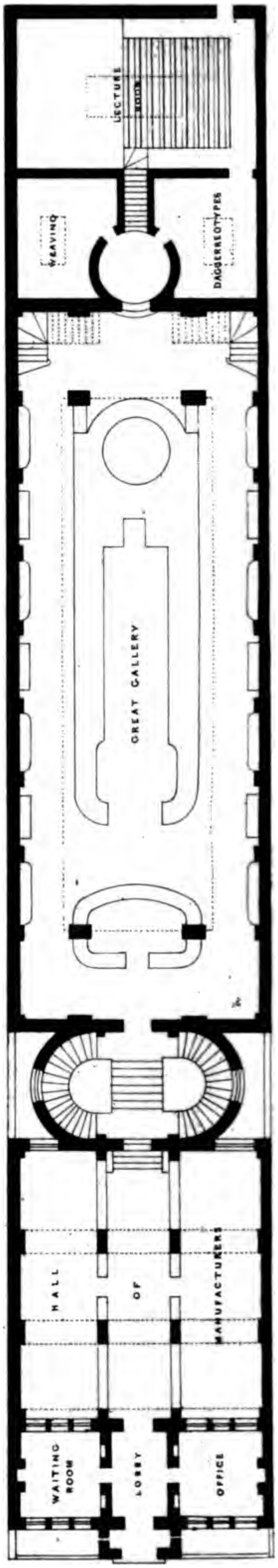
Width 40 Ft

Height 38 Ft



J R. Jobbins, Litho. Warwick Ct

GROUND FLOOR PLAN



POLYTECHNIC INSTITUTION.

With an Engraving, Plate XV.

This institution was founded in 1838, and shortly after its opening we gave a brief description of it at page 318 of our first volume; we now present our readers with some farther details. The annexed engraving gives the elevation, transverse section, and ground plan of the building, and to these we refer our readers as a substitute for a lengthened description. What we anticipated at a former period has since been fully carried out, and this institution has become in its neighbourhood, like the Adelaide Gallery, of great utility in promoting the practical arts. If we have not like at Paris, an *Exposition des Arts et Metiers*, or Mechanics Exhibitions like our provincial towns or American cities, we have at any rate the advantage of them as regards permanent museums, by means of these institutions. The mechanical collections of Paris are now far from equalling those of London, and it wants but very little exertion to give us a decided superiority. We may observe, by the bye, on this subject, that it is much to be regretted that the museum of the Society of Arts is not made more available. We may remind our readers that these exhibitions emanated from the attempt to form a national exhibition of arts and manufactures in the King's Mews.

The design of the building does credit to Mr. Thomson, the architect, for having so skilfully adapted it to the purpose to which it is devoted, the lighting of the great hall is provided for in the coved ceiling or roof, a gallery passes all round the great hall, supported on each side by cantilevers, as shown in the section; on the ground line there is a canal formed for the exhibition of hydraulic works, steam boats, water wheels, &c., and at the end is a circular reservoir for exhibiting the diving bell, and working under water in the diving dress; at the east end is the entrance hall from Regent-street, above is a theatre for lectures, &c., and below a laboratory and other rooms for experiments. The west end of the great hall or saloon communicates with premises in Cavendish-square. The total depth of the premises is 320 feet, and 44 feet wide, and the great gallery 120 feet long, 40 feet wide, and 38 feet high in the centre.

HARBOURS OF REFUGE ON THE SOUTH EASTERN COAST.

In our last month's Journal we gave a few extracts from the Commissioners Report, pointing out some discrepancies, upon which we intended to have made remarks, but upon mature consideration we think it better, instead of contending with details, or occupying ourselves with the misconception of the Commissioners, to look at the question in a broader kind of view and on national grounds, that we may see how far the Government will be justified in recommending Parliament to grant so large a sum of money as is required for carrying out the harbours proposed. In the first place, it is generally admitted that England has not on her south eastern shores any harbours of sufficient magnitude or depth of water to receive a fleet of men-of-war, or even for our largest class steamers, and the absolute necessity of having such harbours is also admitted. It therefore only remains to examine whether the localities selected are the best, and whether there is any necessity for erecting them on the magnificent scale proposed in the report before us. With regard to the latter question, we have only to look at the artificial harbours which have been executed, and we shall generally find that they have been constructed on too small a scale, to render them of any service for shipping, such as men-of-war of the largest class, and in consequence of their contracted scale they soon silt up and bars are formed at their entrances, rendering them almost useless except to merchantmen of small tonnage. With regard to the necessity for harbours of refuge in time of war, there cannot be a doubt; it is therefore highly expedient that harbours should be constructed of sufficient capacity for a fleet of men-of-war, either to sail or be towed in or out at all times of the tide, an hour lost may be the cause of irreparable damage to our coast, a descent on our shores, or the escape of the enemies fleet, and on this account we should be prepared to recommend the construction of harbours on the boldest scale that our finances will allow, for we would rather have one on an extensive scale than we would have half a dozen of the small fry, of these descriptions of harbours we have had enough, and if they are wanted, the local authorities ought to be able to raise funds sufficient without Government aid. We have always been averse to the interference of Government for what may be justly considered private purposes.

We shall now look to the situations selected by the Commissioners, and the first to which our especial attention is required is the harbour of Dover. Here all parties must admit it is a situation that requires to be well provided and well watched; and moreover the passage of the Straits must be made our own, it must be kept at all hazards and at all costs. To allow an enemy's fleet to remain there for a day would be madness, and the only way to avoid it, is to have a good harbour, where in case of need, the largest class steamers may be able to take shelter, for which no situation is so well adapted as Dover.

The next site selected is Beachy Head, where it will be found that there is already a good anchorage, with a situation well adapted for a breakwater similar to that of Plymouth. This would afford shelter for large class vessels between Dover or the Downs and Portsmouth, at present a long line of coast without the slightest refuge for a man-of-war, and consequently without protection for the small merchantmen. The next and last situation is that of Forness, near Margate, which affords protection to the mouth of the Thames, this requires a harbour of spacious dimensions, in which vessels riding in the Downs may take shelter if required. If we view the coast from Margate to Portsmouth, there cannot, on the whole, be found more eligible sites for harbours than those selected, keeping in mind the grand object, that they must be harbours of refuge, not for merchantmen alone, but for the Queen's service also, where vessels carrying 100 or 120 guns may take shelter at all times of the tide, and the steam frigate like the Gorgon and the Cyclops may run in and out with facility, and be ready for action at a moment's notice.

We are therefore under all the circumstances disposed to support, most strongly, the recommendation of the Commissioners, and trust that Parliament when called upon for a grant, will look at the question boldly, and judge whether it be not better to grant four or five millions in the time of peace, rather than wait until war takes place, when shipping to more than that amount may be destroyed in one year.

REMARKS ON MR. TOMSON'S PAPER ON THE WORKS OF SIR JOHN VANBURGH.

The animated and lively discussion at the Institute on Monday evening, manifested in a very pleasing way, that the little citadel of taste is becoming more and more the object of zealous and vigilant scrutiny. The beautiful pourtrayal by Mr. Thomson of Sir John Vanburgh's style, (the subject of Monday evening's attention) though it requires no record of approval from a person like myself, to give it one feature of additional interest, prevents the *silence* of one insensibly attracted by any commentary upon by-gone talent, or the merits of originality. Sir John Vanburgh, recognised as a pupil of Wren, and included in the school of Palladio, seems to display, I humbly imagine, too little of ornamental sweep and the flowings of elegance, too exact a distribution of the several parts, too cool a display of effect, to rank as a disciple of Palladio, or a pupil of Wren; and yet, at the same time, too much of extended variety in bodily proportion, to present a true idea of Grecian sentiment.

Exuberance with him is never beheld in the drooping festoon or the careless sweep of foliated bands. The curves and bendings of elegant contour, deck not the façade, but the care of distribution figures in a thousand lines, in a prim exactness, in a minute attention to the rules of his art. For this he seems to stand isolated from his school, and like Soane, betrays the fretwork of a self-constituted style, connecting and harmonizing the fashion of two rival styles, the Greek and the Roman. More extended—more daring in his ideas than Soane, he seems, like him, to have studied general minuteness. But it is the proportion, the loftiness, and the general effect of magnitude, which infuses in the mind, grand impressions, whilst contemplating Blenheim. It is to this ability in outline, this arrangement of a mass, which creates the desired effect; though the rules of his style appear as licences to an admirer of the Greek or the Roman. With all the blemish of incorrect detail, (if, as to general effect, it be a blemish), Vanburgh had the feelings of an artist, and felt that poetry of sentiment, which shines in his works; though unimbued with the delicate finish of Chambers and a later day.

To comment further upon (in some respects) this Soane of the last century, would be inconsiderate; yet it is a gratification to see the merits of past days recalled—and to pluck from the thousand beds of taste some of those beauties, identified with faded talent and forgotten genius; to see a mind original and rare regaining its buried influence, and asserting it with a liberal and enlightened community of architects.

The deduction in favour of the subject, the nataral effect of Vanburgh's style, is this, that the head of the student, and the heart of the poet—the enquiring mind, and the soul to admire its own researches, must unite in the same man, if that man is to be an architect. A mere knowledge in the existence of this style, or that, or that it flourished in this age, or that, cannot improve the architect, though it may the mind; and unless we can raise ourselves above that pedantry of ignorance, which covets every thing antique, be it dust or marble, we can never rival, nor even faintly imitate, the lovely relics of antiquity.

It is not enough that the column or the pedestal should be brother to some Greek or Roman model, since it is not every one whose brain can swim with the pleasures of a connoisseur. A stranger to Athens or Rome would perhaps turn from the external polish of a modern edifice, however skilfully arranged, and become lost in the strange grandeur of Blenheim.

FREDERICK EAST.

June 18, 1840.

TRUSSED BEAMS.

SIR—In reference to the method of trussing beams, communicated in the 32nd number of your Journal, and said to be invented by Herr Laves of Hanover, I beg to observe that the principle is by no means new to this country. In the practice of Mr. John Brown of Norwich, I have long had occasion to describe, in specifications, precisely the same method for many purposes, but chiefly for the purlins of roofs, where the transverse trusses have, unavoidably, been at a great distance apart. In order to show you, indeed, how little the method we pursue differs from that of Mr. Laves, I will extract from a specification I have at hand the following:—"All lengths of purlins which may exceed 9 feet between the bearings, to be sawn, lengthwise, through the middle of the depth, and trussed as shown by the accompanying sketch* with a wrought iron collar at each end, and a $\frac{5}{8}$ screw bolt with broad clasp irons in the centre.

I remain,
Your obedient servant,
WILLIAM B. COLLING.

Norwich,
June 6*th*, 1840

LOCOMOTIVE ALARUM.

SIR—Various suggestions have lately appeared in the public prints, relative to the best means of communicating an alarum to the engine-man in case of fire or other accident in a railway train.—I would suggest a steam-whistle, which should differ decidedly in sound from those used by the engine-men.—A light chain attached to the cock of the whistle would enable each guard, and (if thought desirable) the passengers in each carriage to give an alarm in case of an accident occurring, or being likely to occur.

The advantage which such an alarum would possess over any other, is, that not only the engine-man, but all the guards and attendants would be immediately on the *qui vive*, and prepared to act as circumstances might require. The disadvantage is, that passengers hearing the alarum, might lose their presence of mind, and endanger themselves by attempting to escape from the carriages, instead of doing the only thing, which can tend to ensure their safety, viz., firmly keeping their sittings.

I am, Sir, your obedient servant,
ROBERT SHEPPARD.

Horsham, Sussex, Aug. 19, 1840.

ON SCREW PILE LIGHTHOUSES.

SIR—A correspondent in your excellent Journal for July, under the signature of "One of the Old School," endeavours to institute a comparison between the patent screw pile, and the common driving pile, the latter of which it is evident enjoys his exclusive favour, on the very rational grounds of its antiquity.

In summing up its superior merits his readers might reasonably expect to have their attention directed to many lighthouses, and other buildings supported by his favourite pile, and placed upon banks of loose sand covered by the ocean.

That he has failed to do so, is for the simple reason that no such structure ever did or ever can exist.

The experiment has indeed been frequently made of driving piles in such positions, and it has happened that owing to the buoyancy of the wood and mobility, and want of tenacity in the sand, they have invariably been found extracted by, and floating on the surface of the succeeding tide.

If then the old pile or pointed stake, which has been in use for at least 20 centuries, has been always found incapable of forming a sound foundation in such positions, how can it reasonably be put in comparison with the screw pile, which within four years of its being made public, has been successfully applied in submarine sandbanks of the most infirm description, and has moreover received the unqualified approbation of the first engineers of the present day.

Of these I might furnish an ample list, but feel the impropriety of giving names of the highest respectability to be handed about in idle discussion with your nameless correspondent.

I may however mention that a screw pile lighthouse, on a sandbank off the mouth of the Thames, is at present in progress of erection, under the auspices of a gentleman who deservedly stands at the head of his profession. And, that another upon a sandbank thirty miles north of Liverpool, was erected during the past winter, at the earnest recommendation of a gentleman well known as an experienced and highly talented marine surveyor, who has no antiquated prejudices standing in the way of recent improvements. And I boldly assert, without fear of contradiction, from any *practical engineer of experience*, that, to construct such a lighthouse on either site upon common piles, would be totally impossible.

As the other objections raised by your correspondent to the screw pile lighthouse, are only supported by his marvelous gift of prophecy, I shall content myself with requesting him to visit the one at foot of Wyre, where he will have proof positive of the fallacy of his conclusions, and when there, if he will drive a common pile into the sand, so as to resist a downward pressure or upward strain, equal to that which the screw pile will bear, I shall at once relinquish the latter as a useless expense.

I am, Sir, your obliged and humble servant,
ALEXANDER MITCHELL.

Belfast, August 18, 1840.

THE SAFETY ROTATION RAILWAY.

(*A New Method of Construction in Railways, and in applying Power to propel Carriages thereon. Patented by Mr. Rangely. March*, 1840.)

FROM A CORRESPONDENT.

THIS invention, of which, in our present number, we can give but a brief description, aims at effecting a complete revolution in the present mode of railway construction and locomotion. In place of having the ordinary rails and wheeled carriages, two series of wheels are fixed along the whole length of the road at about two yards apart, and at an equal distance from centre to centre of each wheel. These wheels are connected throughout the whole length of the line by bands working in grooved pullies keyed on to the same axle as the wheels, but the axles of one side of the line are not connected with those of the opposite line. The axles of the wheels are raised about one foot from the ground, the top of the wheel (which is proposed to be of 3 feet diameter,) will be therefore elevated 2½ feet above the surface. On these wheels is placed a strong framing of timber, having an iron plate fastened on each side in the line of the two series of wheels. A little within this bearing frame, so as just to clear the wheels, is a luggage-box or hold, descending to within a few inches of the ground, in which it is proposed to stow all heavy commodities, for which purpose it is well adapted, opening as it does at either end, and its flooring close to the surface of the ground. At each end of the lower part of the framing of this luggage-box, are fixed horizontal guide or friction wheels working against the supports of the bearing wheels and pullies, by which arrangement curves will be traversed with little friction, and it will be impossible for the framing to quit the track. The framing of timber will be about 19 feet in length, so that it will rest alternately on six and eight wheels, but never on less than six. On this framing the passenger carriages are erected, which, in its progression forward, it is thought will be kept steady and free from lateral motion by the weight in the luggage box, assisted by the horizontal guide wheels. The method by which locomotion is produced, is by putting the wheels in motion by means of machinery at either end, which would be effected for an immense distance with a moderate power, as there would be very little more friction due to the wheels than that arising from their own weight; and the frame, bearing the carriage, would not be run on to the bearing wheels until the whole were in motion, when its weight would act almost after the manner of a fly wheel, resting, as it would, on the periphery of the bearing wheels. It will be perceived that, by this plan, the bearings of the wheels must be kept perfectly in the direction of the plane of the road, whether inclined or horizontal; otherwise serious concussions would occur. But this would not be the case by the depression of one wheel, or even by its entire removal, as the framing will be constructed sufficiently stiff as not to deflect by having the distance of the bearings doubled.

If this plan should be found to answer, it will present facilities of transport never before thought of, as carriages might be continually despatched without a chance of collision, either by stoppage or from increased speed of the last beyond the preceding. It also promises to remove the present great drawback to railway progression, viz. the being able to surmount but very slight acclivities by locomotive power with any profitable load; but by the rotative system, inclines may be surmounted of almost any steepness without the chance of accident. In case a band should break, the action of this railway would not be impeded, as the power being transmitted from either end, rotation would take place throughout its whole length, but the power would not be transmitted from either end past the disjunction. Even should two bands be destroyed at a distance from each other and on the same side of the track, its action would not be destroyed, for although the isolated portion of wheels would be dead, those on the other side of the track would be in action, which, with the horizontal guide wheels, would move forward the carriage, although, on such portion, at a diminished speed. Instead of an increased outlay being required in the formation of railways, on this system it is estimated that a very considerable saving will be effected, as a single track will be sufficient, with sidings of dead wheels at the termination of the several portions into which a long line would be divided. In crossing valleys, a framing of piles to support the bearing wheels would be quite sufficient, and the road might be left quite open between each line of wheels, as it would be impossible for the carriage to quit the track, and therefore no necessity for making a solid road for safety sake. As this system is so novel and *revolutionary* in its mode of action, it will of course meet with numerous opponents who are interested in the present state of things; such as are not wedded thereto, or can admit the possibility of a total change in the system, we would advise to pay a visit to the Polytechnic Institution in Regent Street, where working models of this invention may be inspected.

---

* We have not given the sketch, as it is very similar in principle to those shown in page 161, excepting that in the above, at the end of the slit, there is a key of oak with an iron strap passing round the outside, and in the centre there is a block of oak with a nut and screw bolt passing through it and the top and bottom scantlings.—ED. C. E. & A. JOUR.

THE ELECTRIC TELEGRAPH.

From the fifth Report of the Select Committee on Railways.

As everything connected with the operations of a power the development of which is calculated in its progress to effect very great changes in our social, commercial, and perhaps political condition, must be viewed with no inconsiderable interest, we propose to give, from time to time, condensed but complete abstracts of such portions of the report as we think best calculated to arrest public attention.

The first evidence taken before the committee relative to the magnetic telegraph, for which a patent has been taken out by Messrs. Cooke and Wheatstone, and which is now in operation between West Drayton and Paddington, on the Great Western line of railroad. As it would be impossible without a representation of the dial and apparatus, to impart a distinct notion of the manner in which intelligence is conveyed from one station to another, suffice it to say that the communication is effected by metallic wires made to operate upon fine magnetic needles which point to 20 letters of the alphabet marked upon the dial, being acted upon by electrical currents passing through coils of wire placed immediately behind them.

According to the information contained in the evidence of Mr. C. Wheatstone, professor of experimental philosophy in King's College, there is no necessary connexion between this species of communication and railroads. On the contrary, it can be established on a common road, or even where no road exists, though a railroad, in consequence of the continuity of property which it possesses, is best adapted for the experiment. In answer to a question, "whether (in the event of the Great Western Railway being finished from London) the telegraph could be carried through the whole way?" Mr. Wheatstone replied, that he believed it could be done, and with but little multiplication of power, inasmuch as late experiments had shown, contrary to former opinions, that to send an electric current to any considerable extent, there was no need of a strong battery, a weak one in fact being quite sufficient, provided it consisted of a number of elements proportionate to the distance. The communication between London and Bristol might require some intermediate stations at very considerable distances, though his own opinion was that they would not be required. From experiments which he made some years since, he ascertained that electricity travelled through a copper wire at the rate of about 200,000 miles in a second, being 8,000 miles quicker than the rate at which light passes during the same period.

Mr. Wheatstone states the advantages which the electric possesses over the ordinary telegraph as follows:—" It will work day and night, but the ordinary telegraph will act only during the day. It will also work in all states of the weather, whilst the ordinary telegraph can be worked only in fine weather. There are a great many days in the year during which no communications can be given by the ordinary telegraph, and besides, a great many communications are stopped before they can be finished. on account of changes in the state of the atmosphere; no inconveniences of this kind would attend the electrical telegraph. Another advantage is, that the expense of the several stations is by no means comparable to that of the ordinary telegraph; no look-out men are required, and the apparatus may be worked in any room where there are persons to attend to it. There is another advantage which the electric possesses over the ordinary telegraph, viz., the rapidity with which the signals may be made to follow each other. 30 signals may be made in a minute, a number which could not be made by the ordinary telegraph. There is one thing I will take the opportunity to mention. I have been confining the attention of the committee to the telegraph now working on the Great Western Railroad, but having lately occupied myself in carrying into effect numerous improvements which have suggested themselves to me, I have, conjointly with Mr. Cooke, who has turned his attention greatly to the same subject, obtained a new patent for a telegraphic arrangement, which I think will present very great advantages over that which at present exists. It can be applied without entailing any additional expense of consequence to the line now laid down, it being only necessary to substitute the new for the former instruments. This new apparatus requires only a single pair of wires to effect all which the present one does with five, so that three independent telegraphs may be immediately placed on the line of the Great Western. It presents in the same place all the letters of the alphabet, according to any order of succession, and the apparatus is so extremely simple, that any person, without any previous acquaintance with it, can send a communication, and read the answer."

According to the evidence of Mr. Alexander Saunders, secretary to the Great Western Railroad Company, the expense of laying down the iron tubes through which the magnetic wires pass, and completing the telegraphic line, was from 250*l.* to 300*l.* per mile. To a question as to whether all the advantages which were expected had been derived from the magnetic telegraph, this gentleman replied, "I think we have scarcely had it in a state to say that we have derived all the advantages which were contemplated from it, because between West Drayton and Paddington we have very little inducement to work the telegraph separately for that part; it had much more reference to the more distant stations, and the communications of one line with others, or to communications between places on the line where short and long trains together are running upon the same portion of railroad. As yet we have had no practical benefit of that description, but it has enabled us to ascertain that the telegraph perfectly performs all the duty that was expected of it. As far as it goes it works perfectly true, and if it work as well when the whole line is completed, I fully anticipate all the useful results contemplated from it."

Used with a view to commercial purposes, Mr. Saunders admitted that the sole possession of the magnetic telegraph would give the Great Western company a great advantage over the rest of the public, who could not, and as he conceived ought not to have any remedy, inasmuch as the company were the sole proprietors of the land, and would be at the entire expense of laying down the line of telegraph. If the Government chose to have a line of telegraph along the Great Western Railroad, he did not see any objection, provided the company were adequately paid for the use of their land, and that the line should be used for Government purposes only. A restriction of the use of the telegraph by the company solely to matters relating to the railway, and prohibiting the transmission of other intelligence, would prevent the company from laying down the line. He also thought it would be a great hardship if an expenditure had been incurred by any company in laying down a line under the expectation that they were to derive a benefit from it, whether in transmitting railway or general information, that they should be compelled to permit another company to lay down another telegraph on their line.

Mr. Wheatstone, observing upon the expense, said the cost of the present experiment has exceeded 250*l.* per mile. We will assume that it cannot safely be reduced, though I think with more experience that it might be. If we consider that the cost of laying down the whole telegraphic line from London to Bristol will be only the cost of one mile of the railroad itself, the expenditure will not appear great, considering the benefits to be obtained; this is less than one per cent. on the original estimate of the expenditure. Now with respect to the proposed Government line. The principal expense of laying down the telegraph line is, in fact, the iron tube, and the other things connected with it. The mere cost of the wires is very little, not more than 6*l.* or 7*l.* per mile each; as many wires as you please may be put in the same tube, consequently, supposing an iron tube to be laid down hence to Portsmouth, if wires for three distinct lines were enclosed within it, the expense of each line, considered separately, would be very considerably diminished. One line might be appropriated for the railroad purposes alone, another for general commercial intercourse, and a third for the exclusive use of Government. There would be no difficulty if the Government have a telegraphic line thus associated with others to make the terminations in their own offices,—from the Admiralty in London, for instance, to any office belonging to the same department at Portsmouth, so that information might be sent without communicating with any person but their own clerks. If this plan was adopted, it would do away with every objection which has been made with regard to the injury a private company would do the public by having the conclusive means of intelligence in their own hands, and I am sure any railway company would enter willingly into an arrangement by which the Government might possess an exclusive line, at a very moderate expense—much below that at which they could lay it down themselves. If the new telegraph of which I have spoken succeeds—and it has succeeded perfectly so far as experiments have yet been tried—we might place three telegraphs in connexion with the six wires now used on the Great Western Railway; and these might be applied, as I have said before, to three specific purposes—one exclusively for railway purposes; another, to be let to any persons who choose to avail themselves of it; and another for Government objects."

In answer to some questions, Mr. Wheatstone said, that if Government feared that any third person might, by means of portable instruments, become acquainted with their messages, they should communicate in cypher, of which an extremely safe and simple mode had been devised, enabling a person to communicate with a thousand correspondents so as that it would be impossible for any one of them to read what was intended for another. With respect to the time the apparatus would continue without requiring renewal, he could not say. It depended upon the tubes being kept water-tight, as the wires in that case would remain uninjured for an indefinite period. The wear and tear of the telegraph apparatus from London to Bristol would be far less expense than the wear and tear of the railroad for one mile.

There is one suggestion with respect to the use of the telegraph for railroad purposes which should not be overlooked, being of the greatest importance, inasmuch as all danger from collision would be obviated, and more prompt assistance rendered in case of accident. Mr. Wheatstone's proposal is to have posts through which the magnetic wires can be carried up, and with an apparatus on the top placed at every quarter of a mile along the line. By this means the guard having with him a portable instrument, might communicate a message in either direction of the line at pleasure.

IMPORTANT DISCOVERY IN METALLURGY.

At a recent sitting of the *Academie des Sciences*, M. Becquerel read a paper relating to a most important discovery, namely, the application of the electro-chemical power to the art of metallurgy, especially as regards gold, silver, copper, and lead.

After a few preliminary remarks, explaining the various services which this force can render to natural sciences, to arts and manufactures, the learned academician alluded in particular to the refining of the precious metals; and it will be seen in the course of this analysis the great advantage he has derived from the new methods introduced by him into different branches of industry.

It will also be gratifying to learn, that one of the poorest departments of France possesses a gold, silver, and lead mine, and that the happy results already obtained hold out a still more flattering prospect. The following is an analysis of the memoir presented by M. Becquerel:—

The experiments relative to the application of the electro-chemical power to refining *(metallurgie)* of silver, copper, and lead, without the aid of quicksilver, and with little or no fuel, have been continued by M. Becquerel with constant success: his operations were conducted upon a large scale, and embraced considerable quantities of ores derived from Europe, Asia, and America. The object of these researches was in the first place the immediate separation *(reduction)* of the metals one from the other, and especially of silver and of lead from galena; this operation was effected with so much rapidity, that at the preparatory foundry in Paris four pounds weight of silver can now be drawn off in the metalled state from silver ore in the space of six hours; secondly, the preparation which the ore is to undergo, so as to render each metal capable of being withdrawn by the electric current. This preparation varies according to the nature of the ore, presents no obstacle when the silver is in the metallic state, or in the nature of a sulphate, as usually occurs in Mexico and Peru, but it becomes more complicated when the silver is mixed with other substances; the use of a small quantity of combustible matter is then indispensable in order to effect the roasting at a low temperature.

Ores are generally found in great quantities in those countries, but are for the most part abandoned, owing to the want of sufficient fuel for effecting their amalgamation, or to their being found at too great a distance from the sea to transport them to Europe, unless at an enormous expense.

In Columbia. where large masses of gold and silver ore are found mixed with zinc, the richest are sometimes exported to Europe to be fused, whilst the poorest and those of a medium quality are either rejected altogether, or used to so little advantage, that the mining companies lose by them. Exertions are now in progress for introducing the new methods, which are equally applicable to amalgamation and to the electro-chemical process.

The silver ores which are most difficult of amalgamation are those which contain a large portion of copper and arsenic. Ores of this description are found in considerable quantity, especially in Chili, where the inhabitants frequently offer them to Europeans, by whom they are sometimes taken for ballast for want of freight, and without any certainty of turning them to advantage.

The great difficulty was to be able to treat these substances in Europe so as to obtain, in separate portions, and at little expense, all the silver, copper, and arsenic they contained. This problem has just been solved in a satisfactory manner, and so as to ensure immense advantages to new speculators, who will no longer have to contend with the obstacles met with by their predecessors.

On inquiring into the causes of the delay experienced in working the mines in America, it will be seen that the principal ones arise from the high price of quicksilver, and the great difficulty of draining the water by which the mines are inundated. This is not the case in Asia, in the Russian possessions, which are rich in mineral productions, and yield larger profits from day to day in consequence of the introduction of the improvements lately adopted in Europe for reducing metallic ores. In the silver mines of Altaie the expenses for extracting the ore, process of reduction, and of the establishment, do not amount to a quarter of the rough produce, although the ore in general is of slight tenacity. These advantages are owing to the modern price of labour, the abundant supply of combustible matter and substances required in the fusing, and which are not to be had in America, especially in Mexico and the Cordilleras.

The electro-chemical process can be easily applied to the ores at Altaie; however, in countries where sufficient fuel is at hand, and salt cannot be procured, the fusing operation will be always preferred, except in cases of complex ores, which often exercise the ingenuity of metallurgists.

There are but few silver mines worked in Russia. The only ones of importance are those of Altaie, Nertchinsk, and those of the Caucasus and the Ural; but the great source of mineral riches in that kingdom consist principally of the gold and platina dust (sands), the washing of which engrosses the chief attention of the Government. This process, though methodically conducted, is very imperfect, for a large quantity of the gold contained in the sand is lost; the proceeds, however, are considerable; during the last year no less than 12,200lb. were obtained, upwards of 800,000*l.* value.

The argentiferous and auriferous galenæ which have been subjected to the electro-chemical process are perfectly fit for the extraction of gold and silver by washing. This method requires that the ores should be pulverized and roasted so as to separate the metal from the pyrites and other compounds which detain it. The silver and lead being removed, the ore thus reduced to about half its weight, can be washed with the greatest facility, and one man can wash several hundred pounds per day. This method was tried with the galena (very argentiferous) discovered a few years since at St. Santin Cantalés, in the department of Cantal, and which yielded not more than 2½ grains of gold in every 200lb. of ore, with 30 per cent. of lead. But, upon adopting the electro-chemical process, the same quantity of ore produced something more than three drachms of gold. From this important result it is supposed that the rocks in that part of the country are auriferous, as might also be inferred from the name of the place, Aurilac (*auri lacus*). Another great advantage of the electro-chymical method is, that it enables the metallurgist to separate those portions of ore which contain gold, silver, &c., from those which contain none.

M. Becquerel then alluded to the other uses to which electricity might be applied in the manufacture of metals, especially in the art of gilding silver and copper, as also for taking impressions in copper of medals, bassi relievi, and engravings.

The learned academician concluded by observing that this new and highly important power was only in its infancy, and that it would be impossible to foresee the immense services it was likely to render to the arts.

GRANTON PIER.

There are, perhaps, few engineering works at present in progress in Scotland that seems to attract more general interest than the magnificent pier, now in course of being erected, by His Grace the Duke of Buccleugh, on His Grace's property at Granton, a few miles northward from the city of Edinburgh.

The original object and design for a new pier at Granton, was to supply the wants of the city of Edinburgh in regard to steam-vessel conveyances, that passengers might there embark and disembark with safety, in all states of the tide and weather, without boating—the inconvenience arising from the want of which, both from there not being found a proper site, and the requisite funds for accomplishing so truly desirable an object elsewhere, has been but too long felt and acknowledged in that quarter. Accordingly Mr. Walker of London, that most talented and deservedly celebrated civil engineer, was sent for in the year 1836; and after examining the coast adjacent to the Scottish capital, without any restrictions as to locality, he pitched upon Granton as being the most eligible site for such a work; and having prepared suitable working plans, this great and useful work was forthwith commenced, and has since been unremittingly carried on at the sole expense of a single individual—that distinguished, patriotic, and benevolent nobleman the Duke of Buccleuch.

A brief description of the general plan of the pier may not prove uninteresting here. Granton Pier commences at high water mark on the shore, and runs at right angles with it into the Frith of Forth; it is intended to be about 1,700 feet in length, by about 150 feet in breadth; is to be built chiefly with stone, and founded upon shale rock; it will be so arranged as that it will have a double roadway and front wall, one on either side, with a parapet wall in the centre (with connecting openings between the sides), on each side of which will be a footpath. The sea or front walls will be exactly alike, and so divided that there will be six jetties, and one slip or inclined plane on each side of the pier, and one jetty at its outer end; these jetties will be each strongly faced with timber, and so ingeniously contrived and put together that a platform of planking will be on its top, and an intermediate one below, which will communicate with the roadway by means of an easy stone stair. Each jetty will have two cranes on an improved principle, one at each end, and a double warehouse, in the centre of which the aforesaid stair passes; the jib of each crane will swing right into one of the doors of each warehouse, and obove the hatchways of vessels lying at jetty. The slips or inclined planes are faced with wooden defenders, so that vessels landing live stock, &c., may haul up or down as the state of the tide may be. The depth of water on both sides of the pier, with the lowest spring ebbs, will be twelve feet at low water at the outer end, diminishing very gradually inward; and the bottom is of a soft and fine clay. It is intended that the pier shall have an elegant approach, and a lighthouse at its extremity.

From the principle on which Granton Pier has been carried on, namely, finishing as it goes outward, it has already proved itself to answer better than was anticipated, not only as a place where steamers of the largest size can dash in and out with the lowest ebbs, where the passenger can by a few safe and simple paces step from the steamer into the cab, and drive off at full speed, and *vice versa*, but as a place of accommodation and refuge to all classes of vessels, in all kinds of weather. As a pier from which steamers can arrive and depart with ease at their respective fixed hours, it has already been fairly proved without failure; as a place for despatch, it may be mentioned that one of the large London steamers lately arrived heavily laden—she was unladen and laden again, she disembarked and embarked her passengers, and sailed, all in the course of eight hours. As a place of refuge and shelter it was lately tested, for, with a severe easterly gale of wind in April last, the steam boats plying to the stone and chain piers of Newhaven were obliged to avail themselves of the facilities afforded at Granton; and with the same gale seven or eight steamers might at once have been seen lying snug at, or departing from the western side of Granton Pier. Very shortly afterward, with a similar gale, a vessel in a sinking state, with her crew on board, run for and obtained shelter at Granton at low water, and but for this fortunate escape all hands must have perished.

In addition to carrying on the pier, which has been found to answer so admirably, His Grace the Duke of Buccleuch has formed a splendid new road between it and Edinburgh; and a magnificent hotel and warehouse, and also a pier master's house, adjoining the pier, have been finished lately. It is also in contemplation, if not already commenced, to make a road from Granton Pier to join the Cramond Road to the westward; and a water-work for supplying the pier and houses with good fresh water. Indeed, the improvements at present going forward at Granton with such gigantic strides, may justly be viewed as an era in the history of civil engineering.

It would be improper to close the present account of Granton Pier without observing the credit which it, as a novel and highly important work of engineering, reflects on its judicious and skilful principal engineer, Mr. Walker. The improvements daily going forward in its detail and parts, so ingeniously and carefully concocted by the resident engineer, Mr. Howkins, as well as the excellent arrangements in carrying on the work without in the slightest degree interrupting the extensive and growing trade of the pier, are richly deserving of praise.

The Granton Pier will yet, at no distant day, give facilities to every description of trade, and have resources which time, together with the assiduous endeavours of its noble and indefatigable proprietor, will only disclose. As far as the work has now proceeded, and in proportion as it is capable of doing good, the public are certainly deeply indebted to the Duke of Buccleuch.—*Elgin Courant.*

THE THAMES FLOATING FIRE-ENGINE.

HITHERTO the London Fire Office has had its fire-engines on the Thames placed in vessels or floatsc onstructed of wood, and although built exceedingly strong, yet considerable loss of engine power was sustained, through the vibratory motion of the hull, in addition to which, the bottom of the vessels or floats became soddened and foul, so that great difficulty was experienced in removing them from their moorings to the scene of action. The fire office being about to place another engine-vessel or float upon the Thames, the advantages of a wrought-iron hull were submitted to the committee of management, who decided in favour of the same, and on Thursday, 20th ult., (off Blackwall), a novel and interesting trial took place, on board the said wrought-iron float (built by Messrs. Ditchburn & Mare). The fire engines are by Mr. Tilley, of Blackfriars Road, of larger dimensions and different arrangement than those hitherto used; the handles or levers are placed parallel to the vessel's sides, leaving a convenient passage in the middle of the deck. Thirty men were placed to each handle or lever, (of which there are four,) two on each side, making 120 men; every thing being ready, the order was given to start, when one of the fire-men (holding the branch-pipe) was, by the force of the water entering the pipe, knocked on the deck; the men were instantly stopped: on starting again, it was found that it required four of the stoutest fire-men to manage the pipe, (the nozle aperture of which measures two inches in diameter,) and a column of water was discharged from it, in a direct measured distance of 200 feet. The hull of the vessel was found, under the most violent effect that could be produced upon it, perfectly free from vibration, quivering, or rolling motion; 18 men propelled her by the means of oars, at the rate of 6 miles an hour. The result was highly satisfactory to all parties concerned; but we are disposed to ask, why does not the London Fire Office avail itself of the best motive power—steam. A 10-horse engine would propel such a vessel 10 miles an hour in still water, and double the effect, they can at present produce with manual labour; would be without cessation, and under entire command; the steam could be raised at any time in 15 minutes, and all this for the trifling sum of £500.

STEAM NAVIGATION.

THE EARL OF HARDWICKE EAST INDIAMAN.

ON the 8th ult. we had the pleasure of steaming down the river with a select naval and scientific party, who had met on board for the purpose of inspecting this beautiful vessel with her new improvements, which, to the great credit of her spirited and enterprising owners Messrs. Green, has several of considerable value and importance, but the one with which we were most interested was that of a steam engine of 30-horse power, manufactured by Messrs. Seawards, employed to rotate paddle-wheels placed in the usual position, but without paddle-boxes, and having a skeleton like appearance; these are to be used as auxiliaries to the vessel during light winds and calm weather, or for the purpose of keeping off a lee shore, or on any other occasion when the sail fails its duty; and in order to render these paddles less objectionable, they are constructed so as to be thrown out of gear at a minute's notice, and made to revolve upon their own axis, independently of the machinery, and prevent that resistance in sailing that they would otherwise render. They can likewise be disengaged altogether by withdrawing the several floats separately, that are attached to the shaft of the paddle by arms, similar to the levers of a capstan, and secured on their boundary by a long linked chain which is easily disconnected, and the whole of the paddle-wheel removed in case of stormy weather. The shaft and arms are of iron, and the floats of wood, the latter material being considered easier to handle than if made of iron. The engine works horizontally, and occupies but little space, being 24 feet in length, and but 10 feet wide, in that part of the vessel which is but of little consequence, namely, between the fore and main hatchway, and being entirely between decks, neither part appears above deck, nor in the hold. The boiler is jacketted with two coats of felt, over which is a thickness of two-inch deal planking, which being an excellent non-conductor, entirely retains the heat, and prevents the wood-work in the neighbourhood of the boiler being injured by excessive heat. The fuel used was that patented by Oram, made of pitch, small coal and mud, moulded into the form of bricks, which are stacked up close, and by their compact form appear to occupy but little room; the consumption was 120 bricks of 4 lb. weight each, in 2 hours 12 minutes, or at the rate of a little more than 2 cwt. per hour, burning without smoke—and, according to the patentee, with a more intense heat, and much more economically than that of its rival, coal. The Earl of Hardwicke is of 1000 tons burthen, draws 17 feet of water, bound for Bengal, and is full of passengers, troops and cargo. She left the East India Docks on the 8th ult., worked her engine down to Gravesend, but owing to a strong easterly wind was assisted by a steam-tug, accomplished the distance in two hours and a half, going at the rate of six knots, with all her yards square; upon heaving round at the end of Gravesend Reach, the tug was cast off, and she steamed to the town again by her own engines at the rate of four knots, on a strong ebb tide. On Monday at noon she weighed anchor, light airs W.S.W., steamed down to the Nore Light in three hours by her own engine, and arrived at Spithead at 3, 50 p.m. on Thursday the 13th, beating the Wellington (which she passed on Monday night) by 12 hours. The steam engine being of the most essential service, working upwards of 40 hours. She took her departure from Portsmouth for Calcutta, and is expected to perform the distance in 75 days. On the Friday previous to her departure she was visited by Admiral Bouverie, Sir E. Codrington, Mr. Blake, master shipwright of Portsmouth Dock-yard, and many other naval officers and persons connected with the navy, who expressed themselves highly pleased with the plan.

The "Vernon," a sister ship, upon which the experiment of auxiliary steam was first tried, made the voyage from Calcutta to Spithead, in a very bad season, in 86 days, notwithstanding she had calms and light airs all the way down the Bay of Bengal, when she used her steam consecutively for eight days and nights, and she came from the Cape to Spithead in 42 days, being, we believe, the shortest voyage upon record, during which time she used her steam nine days. Mr. Green, the spirited proprietor of a fleet of these splendid East Indiamen, intends to apply generally auxiliary steam, and there can be little doubt but it must soon be adopted in our men-of-war. The space occupied by the machinery being the same amount as that formerly occupied for a cable tier.

It is a rather curious coincidence that the day on which the Vernon will sail for India, the 10th instant, is also the day fixed for the sailing of the "India" steam vessel of 320-horse power, thus an excellent opportunity will be afforded for ascertaining the comparative advantages of the two plans. Many bets have already been made at Lloyds, that both the "Vernon" (which is the only steamer that has ever made the voyage to India and back), and the "Hardwicke," of 30-horse power each, will make the passage out in less time than the "India" of 320-horse power. Should this prove to be the case, it will satisfactorily establish the superiority of steam applied as an auxiliary over large steam power applied in the usual way.

Iron Boats.—On the 15th ult. there were launched from the building yard of Messrs. Ditchburn and Mare, Blackwall, *two* wrought iron steam vessels *at the same time*, an occurrence we believe never before witnessed on the Thames; one was named the "Swallow," intended for the Baltic, the other "Elberfeld," for the Rhine. Messrs. Penn and Son, of Greenwich, are the engineers for the former, Messrs. Miller and Ravenhill, Blackwall, for the latter; the engines in both vessels are oscillating.

British Steamers on the Nile.—The Oriental Steam Company have purchased the iron steamer Dahlia, which is on the point of starting for Egypt to ply on the Nile, under license of the Pasha, to convey the East India mails and passengers through Egypt.

The British Queen steam ship, which sailed from Portsmouth on the afternoon of the 1st July, arrived at New York on the morning of the 18th, having made the passage in 16½ days. The Britannia steam-ship, the first of Mr. Cunard's Royal mail steamers, which sailed from Liverpool on the afternoon of the 4th July, for Halifax and Boston, reached the latter place on the evening of the 18th, having accomplished the passage, including a stoppage at Halifax, in 14 days and a half.

The Oriental, built for the Peninsula and Oriental Steam Navigation Company, is believed to be one of the finest specimens of naval architecture. She is frigate built; her engines are equal to 450 horse power, and appear to be of the best construction. The elegance with which she is fitted up, and the accommodation which she offers in every department, must render her acceptable to the most fastidious passengers. She is stated to be of 1,673 tons burden. The great cabin is beautifully ornamented with panels of *papier mache*. There are 48 tablets on the doors and sides of the compartment, made of the material by Messrs. Jennens and Bettridge, of Birmingham, prepared in a manner that renders them more durable than oak: they never can decay from dry rot, or become worm-eaten, nor are they combustible, or capable of being broken. The tablets are ornamented in *arabesques a l'orient*, in bronze scrolls of the acanthus, with gold tendrils and leaves, with sea-weed on a primrose ground, which supplementary colours accord well with the black moulding, which is richly covered with burnished gold matted tracery work, that has the appearance of being raised from the ground, and produces an effect alike beautiful by day or lamp light. The makers are entitled to great praise for the introduction of a material capable of admitting so much elegance and taste in decoration.

The Archimedes.—This vessel reached Oporto from Plymouth in 70 hours, being supposed to be the quickest steam communication that has ever been made between these places; and this was effected without her having once had occasion to stop her engines. The distance is about 800 miles.

PROGRESS OF RAILWAYS.

The Queen Dowager's Trip on the Railway.—Extraordinary Speed.—On the recent occasion of the return of the Queen Dowager from Lancaster, a special train was provided for the conveyance of her Majesty and suite, from Lancaster and Preston and North Union Railway Companies, and thence to Stafford, being the nearest point to Alton Towers, the seat of the Earl of Shrewsbury, which was her Majesty's destination, by the Grand Junction Railway Company. The train, consisting of three railway carriages, one of which had been handsomely fitted up by the London and Birmingham Company for her Majesty's use, and five private carriages on trucks, making eight in all—

Started from Lancaster, at	10h. 12m., A.M.
Arrived at Preston Station	11h. 15m.
Stopped there	13m.
And on the Viaduct over the Ribble Valley	6m.
Time at Preston	19m.
Arrived at Parkside	12h. 11m.

Where it was attached to an engine of the Grand Junction Railway. The latter part of the journey, viz., from Newton Junction to Stafford, a distance of fifty-four miles, was performed, exclusive of a stoppage of five minutes, at Crewe, for water, in one hour and thirty-one minutes, or at the rate of upwards of 35½ miles per hour. Her Majesty, on her arrival at Stafford, personally expressed to Captain Cleather, the manager of the Grand Junction Company, who was in attendance, her satisfaction at the rapidity of the passage, and the uncommon smoothness of the line. The engine, the Vandal, on its return, brought back from Birmingham a train occupied by the directors and chief officers of the company, who had been inspecting the line, and holding a board at Birmingham on that day. It left Birmingham at 6 30 P.M., and arrived at Edgehill at 9 2 P.M., having made three stoppages of five, four, and three minutes; thus running the distance in two hours and thirty-two minutes, or at the rate of thirty-eight miles an hour including stoppages, or forty-one miles an hour exclusive of them. This is believed to be the most remarkable performance, for a continued distance of this extent, that has yet taken place on this or any other railway in the kingdom. This engine, in both its trips, was under the direction of Mr. Buddicom, the superintendent of the locomotive department of the company.

THE NORTH UNION RAILWAY.

ENGINEER'S REPORT TO THE DIRECTORS.

GENTLEMEN—In drawing to a close the construction of the North Union Railway, I consider it will be satisfactory to the Directors and Proprietors to have the detailed cost of the several great heads of expenditure brought into one view before them. It is due to myself and the other officers of the Company, that the quantity of work executed for the money should be set forth; and without any thing beyond a simple statement of facts in this respect I shall be content, should this report be promulgated, to leave the Shareholders in this concern and the public to form their judgment. I likewise conceive that, as the first authentic detailed document of the kind, it may be taken as the commencement of similar statements which will hereafter be brought forward, and thereby be the means of collecting that statistical information on the Railway system, which has naturally, and of late, been so much sought after.

It should be noted that the total length of line embraced herein is 25 miles; the main line from Parkside through Wigan to Preston being 22 miles, and the New Springs Branch 3 miles; and it should be observed, that from the peculiar nature of this railway, the total extent of sidings, extra lines, &c. is very much above the usual proportion.

In the total sum of £578,931 16*s*. 2*d*. (say in round numbers £580,000,) is included the cost of re-laying the old line between Parkside and Wigan; the Cottages now building along the line; the maintenance of the Railway by the Contractors, for two years, from the respective openings; and not only all that has been already expended on the several items, but that which is now in progress, or contemplated to be done, to make the railway complete, and to draw the line at the foot of capital account.

From a consideration of the nature of the works on this line, many of them of a gigantic character, particularly the Ribble Viaduct, and including the various slips and accidents, I hope I may be permitted to consider the average cost of £23,157 per mile as a moderate amount, including, as it does, stations, carrying establishments, interest, and management.

The actual cost of the Railway itself has been only £15,793 per mile, exclusive of land; and if the peculiarly heavy expense of the Ribble Viaduct (consisting of five arches of 120 feet span each, erected at a cost of about £44,885, including all contingent extras) be excluded, as it fairly might, for comparative results, the cost of the works alone is £13,998 per mile; the purchase of land for the railway is £1,974 per mile additional; £3,517 is the cost per mile for the stations and carrying establishments; and £1,872 per mile for interest and management. Separating the latter item from the interest, it will be seen that the whole expense of the superintendance of the North Union Railway, over a period of ten years of greater or less activity has scarcely exceeded 7 per cent. This item is, of course, not in the engineer's department, but it is due to the managing officer of the Company to state the circumstance: it will also be found that the average quantities per mile are—of earth work, 116,120 cubic yards, averaging under 10½*d*. per yard; of masonry, 4000 cubic yards, averaging 22*s*. 7*d*. per yard; and of iron, 287 tons, averaging something below 9*l*. 15*s*. per ton.

In respect to the mode in which the difficulties presented by the physical obstructions on the face of the country have been surmounted, by the adoption of gradients of 1 in 100 to a considerable extent, and thereby a vast saving effected in the construction of the railway, I hope to be able to demonstrate, at the close of the first two years' entire working of the line in October next, that, with the exception of some very little addition to the quantity of fuel, the cost of working the North Union Railway, reduced to a rate per mile per train, is *below* that of other lines with superior gradients, while the trains and rate of travelling are at least equal to the averages elsewhere; and I feel confident of being able shortly to give a very close approximation of what that average expense is per mile per train, including all the deductions from the gross receipts, before declaring a dividend.

There being then but little difference, as far as observation and experience have hitherto gone, in the working trains of passengers and light goods on railways, differing considerably in gradient, at velocities and with loads such as usually occur, the high importance of economy in the first construction is self-evident. It has thus told effectively on the Grand Junction Railway, and I trust will be equally felt on the Midland Counties Railway, each of which lines, with similar equipments to those on the North Union Railway, will be found to have cost at about the same rate, or but little exceeding it, say certainly within £25,000 per mile. Reducing the whole expenses on the North Union Railway to round numbers and to a per centage, the account will stand as follows:

		Total.	Per cent.	Per mile.
	Earth Work	£126,000	22	£5000
	Masonry	120,000	21	4800
	Fencing	21,000	3½	800
Upper Works.	Railway laid complete	61,000	10½	2400
	Iron	67,000	11½	2700
	Land and Damages	50,000	8½	2000
	Stations	44,000	7½	1800
	Carrying Establishment	44,000	7½	1800
	Interest	5,000	⅘	200
	Management	42,000	7⅕	1700
		£580,000	100	£23,200

But to enable a more critical examination to be made, I shall subjoin the following abstract:

Abstract of the Cost of the Works upon the Line of the North Union Railway—25 miles—with the General Heads of Expenditure in the various Departments.

	£	s.	d.	£	s.	d.
EARTH WORK........ 2,903,028 cubic yards, (average 10⅜*d*.) per yard	£125,676	3	11			
MASONRY and BRIDGES.—100,265 cubic yards						
Masonry	£113,096	0	5			
325 tons Iron Work	3,875	0	0			
25,022 cubic feet Timber	3,277	14	8			
FENCING and DRAINS.—87,712 lineal yards. —*N.B. This includes Road Diversions, &c., Gates, &c. &c.*	20,533	2	7			
UPPER WORKS.—6,885 tons of Iron Rails and Chairs	66,833	17	7			
91,545 lineal yards of Railway, laid on Blocks and Sleepers, including Ballast, Drains, Walling, Bolts, Keys, Felt, Plugs, and small Materials and Labour	61,538	0	2			
				£394,826	19	4
LAND and DAMAGES.—320 acres for Railway				49,342	3	10
STATIONS.—Land for Stations	£17,257	15	5			
Station Buildings	13,589	8	1			
Warehouses	9,266	0	0			
Fixtures, Turnplates, and Sundries	4,164	16	6			
CARRYING ESTABLISHMENT.—Repairing Shops, Tools, and Fixtures	11,854	0	0			
Locomotive Engines, Tenders, &c.	18,863	6	7			
Carriages, Horse Boxes, Trucks, &c.	12,934	17	10			
				88,960	4	5
INTEREST.—Interest Account, Rates, Taxes, &c.	4,746	15	8			
MANAGEMENT.—Parliamentary and Law Expenses	17,147	8	0			
Engineering and Surveying	6,193	5	9			
Office Expenses, Travelling, Advertising, &c.	3,134	19	2			
Salaries	15,580	0	0			
				46,802	8	7
TOTAL COST . . £23,157 5 6 per mile,—or—				£578,931	16	2

It should also be mentioned that, of the above land there remains to the value of about four or five thousand pounds available for re-sale; and, in conclusion, I trust that the dividend of nearly 7 per cent. per annum out of the clear profits of the Railway, since its entire completion and opening throughout, in October, 1838, to the present time, with a prospect of a steady increase, is a sufficient proof of the soundness of the concern; and with my grateful acknowledgments to the Directors for their invariable kind support amidst many trying difficulties, now happily surmounted.

I have the honour to subscribe myself,
Their very faithful servant,
CHARLES VIGNOLES,
Engineer-in-Chief.

4, Trafalgar-square, London,
August 4, 1840.

PUBLIC BUILDINGS, AND IMPROVEMENTS.

New Church at Golden Hill.—On Monday, 3rd ult., the first stone was laid of a new church about to be erected at Golden Hill, a populous village situated at the northern extremity of the Potteries. The church will contain 500 sittings, one-half of which will be free. Mr. Stanley is the architect, and Mr. Shufflebotham is the builder, and it is expected that the building will be ready for consecration in the month of July next year.

New Church at Hill Top, West Bromwich.—On Tuesday, 4th ult., the first stone of this church was laid. The architect is Mr. Robert Ebbells.

The Nelson Pillar.—On Friday, 7th ult., the Duke of Northumberland, Sir George Cockburn, Mr. Herries, Sir Peter Laurie, and other members of the Nelson Testimonial Committee, met at the National Gallery on the subject of the magnificent pillar now rapidly rising in Trafalgar-square. The brick-work appears above the hoarding, and will soon be very conspicuous, and the committee expressed their warm approbation of the energy manifested by the contractors, Messrs. Grissell and Peto. It appears from what has recently taken place before the members, that the altitude of the pillar is not to be so great by 30 feet as was at first contemplated. Mr. Bailey is at work upon the figure of the naval warrior, which is to be of Portland stone, and for the execution of which the sculptor is to receive 1000 guineas. It is calculated that Portland stone will retain its colour and polish upon being strongly saturated, better than bronze; and Mr. Croker instanced the Nelson statue of Dublin as a proof of the superiority of the former. Mr. Lough is to execute "the lions" at the pedestal; but they are not to be commenced until the near approach of spring, when it is expected the subscription will receive numerous additions. A committee of the House of Commons reported a little while ago that the Nelson pillar ought not to be raised in Trafalgar-square, but the house having taken no notice of the suggestion, the work will proceed without a check to completion. The project of a new site would not, it is conjectured, be very kindly received, as government gave the ground, and contributors gave their money, expressly for the purpose of raising the testimonial on that spot to the great naval hero of England.—*Daily paper.*

Blackfriars Bridge.—We are requested to call the attention of the public, and especially of the different paving committees, to the paving of the carriage way now in progress on Blackfriars Bridge. It is the first time the narrow paving has been tried in this metropolis, and it is considered a very great improvement, as a horse will not be so liable to slip as on wider stones. The blocks are principally of Guernsey granite, 9 inches long, only 3 inches wide, and square at the top and bottom. The substratum is formed of a concrete 12 inches thick, of stone-lime and Thames ballast. The contractor is Mr. John Mowlem, of Paddington, who has, we hear, met with very great difficulty in obtaining the granite from Guernsey. It is considered the best piece of paving in London, and it is supposed that the bridge will be open in about a week.—*Times. Aug.* 27.

Chard Canal.—This undertaking, which has now occupied six years, is fast approaching to completion. The whole extent of the line, with the exception of a mile and a half of its basin, is almost finished. The principal and only hazardous point is now the reservoir in Chard Common; here the attempts to make a bank have once or twice already failed, but increased labour and perseverance will, we trust, overcome the obstacle, and within a period of six months we trust the reservoir may present an immense sheet of water, occupying a space of 70 acres. The expenditure on the works has been very great; during the last year £20,759 4*s.* 9*d.* has been expended, and the whole expenses have been £26,479 16*s.* 9*d.* Of the 1,140 new shares created by the committee in April last, 992 have been taken. The proprietors have now a very cheering prospect, as the committee hope and expect the canal will be completed in the early part of next year.—*Western paper.*

Napoleon Monument.—A model of the monument proposed to be executed to the memory of Napoleon, has been erected beneath the dome of the Invalides, under the direction of M. Marochetti, for the purpose of ascertaining its effect; from the description, it seems to combine simplicity with grandeur. It stands in the centre of the mosaic work, beneath the dome, and is composed of four parts. The first is a vast base, surrounded by columns and bas reliefs, supporting, at its corners, four statues, one of which holds the globe, another the sceptre, a third the emblem of justice, and the fourth the imperial crown. On this base rests another, half the height of the first, two-thirds smaller in extent, also adorned with bas reliefs, and having, at its angles, four eagles, with outspread wings. From this second base rises a pedestal 8 feet in height, likewise enriched witth bas reliefs, having in its centre the single word "Napoleon." And finally, on this pedestal, stands the colossal equestrian statue of the Emperor, wearing the imperial mantle, and having the laurel crown upon his brow. His left hand holds the bridle, and in his raised right hand is the sceptre of empire. The two bases and pedestal are 40 feet in height, and the equestrian statue is 15; the eagles are 6 feet high, and the four figures on the lower base of the same proportions as the imperial figure. The colossal and pyramidal form of the monument gives us the impression of being well adapted to its site beneath the vast dome of the Invalides. It will be entirely of bronze, and three years are assigned for its execution.—*Athenæum.*

Draining the Haerlem Lake.—M. Dietz, a celebrated Dutch engineer, has invented a machine which it is supposed will be adopted for this purpose, and by means of which he calculates that 100,000 cubic ells of water may be drained off daily. This ingenious person estimates the body of water contained in the Haarlem Sea at 770,000,000 of cubic feet, to empty which it would require 10 of his machines of 30 horse power each, the quantity drained off by them daily being 1,000,000 of cubic feet, thus making the period required for its entire removal 800 days. The estimated expenditure of this work, second only in grandeur and importance to the Thames Tunnel, is as follows:—

	Florins.
10 machines, at 30,000 florins for each	300,000
Coals, &c., 500 florins per diem for 800 days	400,000
60 workmen at 1½f. each per diem for 800 days ..	72,000
Superintendence, plans, &c.	25,000
Total	797,000
About	£66,416

MISCELLANEA.

ELECTRO-CHEMICAL GILDING.—M. De la Rive, of Paris, has been very successful in gilding by electricity. This kind of gilding is thicker and firmer, as has been proved by the experiments to which it has been subjected by a Parisian goldsmith, who was requested to examine it. A vase, gilt by this process, was heated in a fire to a red heat, and then thrown into cold water, and when taken out was found to have lost nothing of its lustre.

Steam Boiler.—Lieutenant Janvier, of the French navy, is said to have discovered the means of getting up the steam of engines with such rapidity, that in ten minutes from the first lighting of the fire, and although the water in the boiler be quite cold, a vessel may be set in motion. This is, it is added, to be accomplished without any additional apparatus, and at very little expense.

Government School of Architecture.—The Lords Commissioners of the Admiralty having come to the determination that a civil architect's department shall be established at each of Her Majesty's dockyards, the whole to be under the superintendence of Captain Brandreth, of the Royal Engineers, the following are the names of officers who will be attached to the department at Woolwich dockyard:—Lieutenant William Dennison, Royal Engineers; Mr. William Scamp, Clerk of Works; Messrs. Colborne and Young, Assistants; Mr. John Hopkins, superintendent of bricklayers; Mr. William Reed, superintendent of carpenters.

An Iron Express Coach, for crossing Sandy Deserts.—The want of a vehicle of this description has long been considered a desideratum by European travellers, in their toilsome journeyings across the arid and scorching deserts of Egypt and Arabia. Hitherto the means of conveying travellers or merchandise over these extensive and barren sands has been by camels and dromedaries, for wooden carriages of any construction were utterly useless, as it was found impossible to discover any species of timber that could resist the intense heat of those districts, which soon splits and rends the best seasoned timber. British ingenuity has, however, found out a mode of overcoming the difficulty, by substituting *iron* for *wood*. In fact a carriage has been constructed, under the direction of Mr. Waghorn, by Messrs. Theodore, Jones, and Co., of Spitalfields, the patent iron wheel manufacturers. This vehicle, which is calculated to hold six persons, their stores, water, &c., has not the smallest portion of wood in its construction. The frame-work, the wheels, shafts, flooring, benches, &c., are all of wrought iron bars, either flat or round according to purpose required, the bottom being open like a net work to allow the temperate air to come up freely, and drive out the hot air as it generates through the top valves. There are hair cushions placed on the benches, which form seats quite as comfortable as those of any other coach. The machine is hung on the centrical spring principle, which discharges the weight from the horse, and throws it on the wheels—this is another great advantage in a hot country. It will thus afford, when brought fully into operation, a safe and comfortable conveyance for travellers, despatches, and the lighter articles of commerce, and is likely to be the means of opening extensively that easy intercourse between Palestine, Persia, Arabia, and Egypt, which is greatly wanted, and would vastly extend the bounds of human knowledge, commerce, and civilisation.—*Morning Herald.*

Improvements in the construction of furnaces and in boilers; patented by Philippe Marie Moindron, Bedford Place, Russel Square, July 31.—These improvements are with a view to bring into action, more fully than is now practised, the useful properties of caloric, by the combined using of polished reflecting surfaces and non-conducting materials, by which means the heat evolved is reflected on to the surface of a boiler or other apparatus. The heat is prevented from passing away without fulfilling the duties to which it is applied. First, to envelop the boiler or other apparatus with a reflecting surface, at such a distance that the heat can pass between the reflecting surfaces and the surfaces to be heated, but in so applying reflecting surfaces, care is to be observed in arranging the same, that they may be conveniently got at from time to time to be polished. The materials employed for obtaining heat, when working the invention, are combustible gases and spirits, or fatty matters, which are consumed by burners or lamps. The boiler is placed on a frame that will allow the gas flame, from three or more concentrical and perforated rings, to pass round; the outer casing is made of any non-conducting material, and the lining nearest to the boiler consists of polished steel; the draft of air below supports combustion. Tea-kettles, or other culinary articles, may be encased with this reflecting surface and non-conducting material, whereby is obtained great economy of fuel and heat.—*Inventors' Advocate.*

Apparatus for regulating the supply of water to steam boilers; patented by James Knowles, Little Bolton, Lancashire, July 10.—Claims the use of a self-acting apparatus, the working parts of which are within the boiler, and communicate to the supply-valve from without. A lever or rod is placed longitudinally on a fulcrum within the boiler, the longer end of which is an up right rod, with a float attached thereon, passing to the outside of the boiler; at the shorter end of the lever is another upright rod connected with the supply valve, working in a tube. As long as there is plenty of water in he boiler, the float will continue to press up the long end of the lever, and, consequently, cause the valve on the upright rod of the short end of the lever to press down on its bearing, and prevent the admission of water from the tank. But when the height of the water in the boiler diminishes, the float lowers with it, and thereby forces up the rod with the valve, thus admitting a further supply of water until the float again rises to close down the valve. —*Inventor's Advocate.*

Preserving Wood from decay; patented by Arthur Howe Holdsworth, Brookill, Devonshire, July 21.—The object of this invention is to preserve wood or timber from decay by immersing it in certain liquids, having the properties of receiving a temperature capable of charring or searing the surface of wood that has been exposed to their action, and of concreting or hardening more or less by subsequent cooling, so as to remain in those pores into which they have previously entered, as well as to cover the surface of the wood, and thus prevent it from the injurious effects of air and moisture. The liquid employed is composed of tar, pitch, resin, or tallow, or that of its products, where it has been subsequently inspissated. This liquid, which can be brought to a higher degree of temperature than water, is placed into a suitable receiver, into which the wood is immersed, and allowed to remain until all bubbling ceases, occasioned by the air passing from the wood. When the wood is required for flexible purposes, such as the decks of vessels, &c., then it is only allowed to remain in the liquid while at a temperature ranging from 212° to 120°—but for charring or searing the wood, the liquid must be brought to the boiling point. The receiver has a cover with ascending pipes, to take off the inflammable vapour rising from the tallow, tar, pitch or resin. When the wood is removed from the liquid, it must be dried in suitable ovens.—*Ibid.*

LIST OF NEW PATENTS.

GRANTED IN ENGLAND FROM 30TH JULY TO 27TH AUGUST, 1840.

John Louis Bachelard, of Saint Martin's Lane, Gentleman, for "*improvements in the manufacture of beds, mattresses, chairs, sofas, cushions, pads, and other articles of a similar nature.*" Communicated by a foreigner residing abroad.—Sealed July 30; six months for enrolment.

Felix Troubat, of Mark Lane, London, Merchant, for "*improvements in the manufacture of vinegar.*"—August 1; six months.

William Daubney Holmes, of Lambeth Square, Surrey, Civil Engineer, for "*certain improvements in steam engines, and in generating and applying steam as motive power.*"—August 1; six months.

Thomas Barnabas Daft, of Birmingham, Gentleman, for "*improvements in inkstands or inkholders.*"—August 1; six months.

James Taaffe, of Shaw Street, Dublin, Slater and Builder, for "*improvements in roofing and slating houses and other buildings.*"—August 1; six months.

James Hodgson, of Liverpool, Engineer, for "*a new mode of combining and applying machinery for the purpose of cutting and planing wood, so as to produce plane or moulded surfaces.*"—August 3; six months.

John Sanders and William Williams, of Bedford, Iron Founders, and Samuel Laurence Taylor, of Old Warden, in Bedford, aforesaid, Machine Maker, for "*improvements in ploughs.*"—August 3; six months.

George Edward Noon, of High Holborn, Engineer, for "*improvements in pumps and in engines for drawing beer, cyder, and other fluids.*"—August 3; six months.

William Saunders, of China Terrace, Lambeth, Chemist, for "*certain improvements in paving streets, roads, and ways.*"—August 3; six months.

William Beetson, of Brick Lane, Old Street, Brass Founder, for "*improvements in water closets and stuffing boxes, applicable to pumps and cocks.*"—August 5; six months.

Colin Macrae, of Cornhill, Perthshire, Gentleman, for "*improvements in rotary engines, worked by steam, smoke, gasses, or heated air, and in the mode of applying such engines to useful purposes.*" Communicated by a foreigner residing abroad.—August 5; six months.

Theophilus Richards, of Birmingham, Merchant, for "*improvements in cutting or sawing wood.*" Communicated by a foreigner residing abroad. —August 5; six months.

Henry Trewhitt, of Newcastle-on-Tyne, Esquire, for "*improvements in applying the power of steam engines to paddle-shafts used in propelling vessels.* Communicated by a foreigner residing abroad.—August 7; six months.

Robert Stirling Newall, of Dundee, Gentleman, for "*improvements in wire ropes, and in machinery for making such ropes.* Partly communicated by a foreigner residing abroad.—August 7; six months.

Andrew Smith, of Princes Street, Leicester Square, Engineer, for "*certain improvements in carriage wheels, rails, and chairs, for railways.*"—August 7; six months.

Thomas John Davis, of 5, Bloomsbury Square, Esquire, for "*certain improvements in the form and combination of blocks of such materials as are now used, or hereafter may be used, in building, or, for paving public and private roads, and court yards, or public and private causeways and subways, or any other purposes to which the said form and combination of blocks may be applied.*"—August 8; six months.

Downes Edwards, of Surbiton Hill, Kingston, Farmer, for "*improvements in preserving potatoes and other vegetable substances.*"—August 8; six months.

John Isaac Hawkins, of College Place, Camden Town, Civil Engineer, for "*an improvement or improvements in buttons, and in the modes of affixing them to clothes.*" Communicated by a foreigner residing abroad.—August 8; six months.

Francis William Gerish, of East Road, Ironmonger, for "*improvements in apparatus to be used as a fire escape, also applicable to other purposes where ladders are used.*"—August 8: six months.

Samuel Howard, of Manchester, Engineer, for "*certain improvements in boilers and furnaces,*"—August 8; two months.

Baron Charles Wetterstedt, of Limehouse, for "*improvements in preserving vegetable, animal, and other substances, from ignition and decay.*" August 11; six months.

John Peter Isaie Poncy, of Well Street, Oxford Street, Watch Dealer, for "*improvements in clocks and chronometers.*" Communicated by a foreigner residing abroad.—August 13; six months.

Miles Berry, of Chancery Lane, Patent Agent, for "*certain improvements in the arrangement, construction, and mode of applying certain apparatus for propelling ships and other vessels.*" Communicated by a foreigner residing abroad.—August 14; six months.

Pierre Armand Le Comte de Fontainemoreau, of Skinners Place, Size Lane, Gentleman, "*certain improvements in covering and coating metals, and alloys of metals.*"—August 15; six months.

John Young, of Wolverhampton, Ironmaster, for "*improvements in the manufacture or construction of knobs, handles, frames, tablets, boxes, and other ornamental articles, applicable to the decoration of houses and domestic furniture.*"—August 17; six months.

Luke Hebert, of Birmingham, Civil Engineer, for "*improvements in the manufacture of needles.*"—August 17; six months.

Joseph Lockett, of Manchester, Engineer, for "*certain improvements in manufacturing, preparing, and engraving cylinders, rollers, or other surfaces, for printing or embossing calicoes, or other fabrics.*"—August 27; six months.

Charles Smith, of Exeter, Builder, for "*improvements in the manufacture of lime and cements, or compositions.*"—August 27; six months.

William Church, of Birmingham, Civil Engineer, for "*improvements in fastenings applicable to wearing apparel, and in apparatus for making the same and like articles, and also in the method or methods of preparing the said articles for sale.*"—August 27; six months.

Hugh Unsworth, of Blackood, Lancaster, Bleacher, for "*certain improvements in machinery or apparatus for mangling, drying, damping, and finishing woven goods or fabrics.*"—August 27; six months.

Thomas Robinson Williams, of Cheapside, Gentleman, for "*certain improvements in measuring the velocities with which ships or other vessels or bodies move in fluids, and also for ascertaining the velocities of fluids in motion.*"—August 27; six months.

Benjamin Hick, Junior, of Bolton-le-Moors, Lancaster, Engineer, for "*certain improvements in regulators or governors for regulating or adjusting the speed or rotary motion of steam-engines, water-wheels, and other machinery.*"—August 27; six months.

Henry Waterton, of Fulmer Place, Gerards Cross, Buckingham, Esquire, for "*improvements in the manufacture of sal ammoniac.*"—August 27; six months.

TO CORRESPONDENTS.

Communications received from Mr. Francis; J. H. *on Felling of Timber; and* "A Lover of the Beautiful," *will appear next month.*

New Town Hall at Ashton-under-Lyne will appear in a future number.

The Reform Club next month.

Reports for the Improvement of Lough Erne; Steam Navigation in France; Anthracite Pig Iron, and some others; also The Architecture of Liverpool; will appear in the next Journal.

Mr. Pinkus' *communication was received too late for insertion in this month's Journal; it shall appear, if he wishes it, with some slight modification next month.*

"A Lover of Machinery." *We have before alluded to the ingenious Traversing Crane adopted by Messrs. Grissel & Peto at their works at the Reform Club, and since introduced at the building of the New Houses of Parliament.*

"Robertus" *could not have seen our two last numbers when he sent his communication respecting the* "*Atmospheric Railway.*"

"Anagnostes" *on Railway Curves, must stand over with others on the same subject.*

Mr. Wightwick's *new work,* "*Palace of Architecture,*" *will be noticed in the next Journal.*

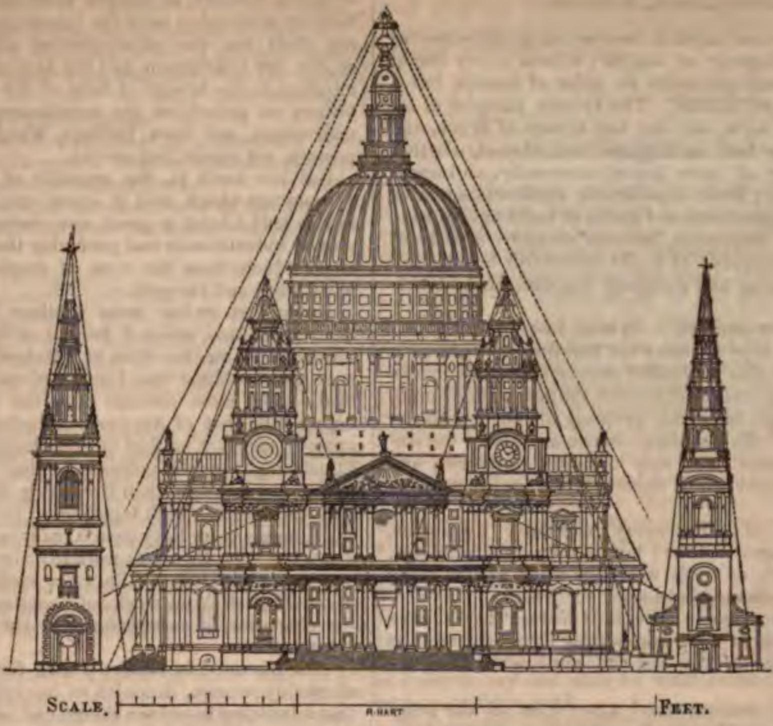
Communications are requested to be addressed to "The Editor of the Civil Engineer and Architect's Journal," *No. 11, Parliament Street, Westminster.*

Books for review must be sent early in the month, communications on or before the 20th (if with drawings, earlier), and advertisements on or before the 25th instant.

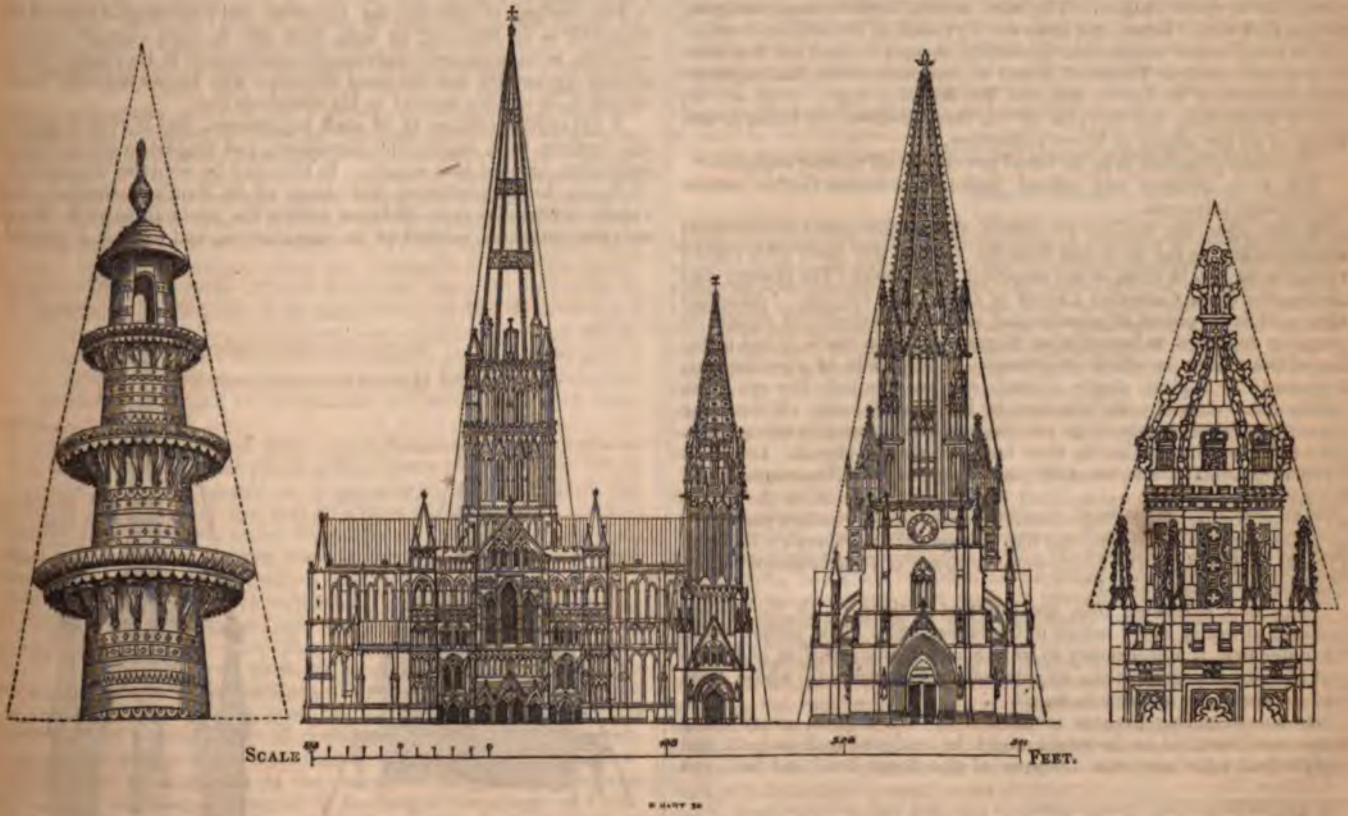
THE FIRST VOLUME MAY BE HAD, BOUND IN CLOTH AND LETTERED IN GOLD. PRICE 17*s.*

⁂ THE SECOND VOLUME MAY ALSO BE HAD, PRICE 20*s.*

ON BEAUTY OF OUTLINE IN BUILDING.



BOW ST. PAUL'S FACADE. ST. BRIDE'S.



Shaking Minarets of the Mosque at Armedabad.

SALISBURY.

ST. PETER'S, CAEN.

FREIBOURG.

Four great angle turrets of King's College Chapel, Cambridge.

*Of Beauty of Outline in Buildings; of the Inferiority of the Moderns, compared in this respect with the Ancient Masters; and of the inutility of Decoration, without goodness of Outline.**

By Alfred Bartholomew, Architect.

But that for which the ancient masters are so eminently superior to the modern architects, is elegance of outline: almost every one of the old buildings, however exceptionable in point of details, has a grand, a neat, and a picturesque outline. The Gothic steeples of all countries, the dome of Saint Paul's, and the bell-towers of Wren, and numerous other old buildings both in England and abroad, whether viewed from afar or near, they all have almost universally, an imposing and agreeable appearance; their considerate architects, seem at once to have designed the elegant outward shells of buildings, so as to contain amply all the internal requisites, without unsightly additions; or if from any necessity, enlargement of a pile afterwards became necessary, the picturesque massing and grouping together of the buildings was never lost sight of.

But what is the mode now pursued? In most instances very different. A debased exterior copy of some old building, is made on a small scale, in base materials; this pretended economical crust, in nine cases out of ten, is discovered eventually, to be neither high enough, long enough, nor broad enough, to contain properly all the accommodations and internal details of the building: hence are added the external incumbrances of lantern-lights, ugly dormers, chimneys, and other deforming excrescences, for which modern buildings are so celebrated.

Nature, always contrives to place every necessary apparatus, within the compass of the general outline; but most modern buildings, exhibit the same contrivance, as birds would, if their giblets being omitted within, were afterwards skewered upon their backs.

If a building at a distance, appear ugly, it is in vain that it have delicate enrichments, and that it be composed of rich materials; it cannot please either the vulgar or the tasteful, nor can the scientific give it commendation.

The qualities of form and outline, stand apart from all the petty quarrels about orders and styles, by which unskilful professors have pestered and lowered a once-noble art.

The most picturesque edifices of all countries, have a wonderful similarity in their outline. The most perfect architectural composition is that which forms one immense Pyramid of Decoration consisting of many minor subservient pyramidal masses:—such are the celebrated Indo-moslem Tombs of Akbar at Secundra, Shere Sha at Sosseram, Humaioon at Delhi, and the Tâj Mahal at Agra: such are St. Paul's Cathedral, the steeples of St. Mary-le-Bow, St. Bride's, and those of all the others of Wren's churches.

The same principle is to be found governing all Gothic steeples.

The same delicate and refined principle pervades Gothic turrets and moslem minarets.

While upon the subject of outline, the author cannot refrain from contradicting, as far as in him lies, the opinion put forth with regard to spires by Mr. Britton, in his exquisite work upon '*The History and Antiquities of the Cathedral Church of Salisbury*,' (p. 74). 'Although this spire is an object of popular and scientific curiosity, it cannot be properly regarded as beautiful or elegant, either in itself, or as a member of the edifice to which it belongs. A May pole or a poplar tree, a pyramid or a plain single column, can never satisfy the eye of an artist, or be viewed with pleasure by the man of taste. Either may be a beautiful accessory, or be pleasing in association with other forms. The tall thin spire is also far from being an elegant object. Divest it of its ornamental bands, crockets, and pinnacles, it will be tasteless and formal, as we may see exemplified in the pitiful obelisk in the centre of Queen Square, Bath; but associate it with proportionate pinnacles, or other appropriate forms, and like the spire of St. Mary's Church in Oxford, and that of the south-western tower of Peterborough Cathedral, we are then gratified.'

Very odd reasoning this, and quite at variance with the in-born feelings of nearly every native of Christian lands. The author would have deemed it unnecessary to refute such a passage if it had been put forth by any other than an antiquarian gentleman to whose taste and perseverance we owe so much.

By the denuding process mentioned by Mr. Britton, every thing accounted beautiful in the world might be rendered both uncouth and ugly: thus, take away the features of the finest head and face, you have remaining a raw skull: take away the sauce garniture and cookery of a feast, and you leave but crude flesh, raw vegetables, and a few other things equally untempting.

The builders of the Christian steeples, those outward beacons of a religious country, so caught from the true sublime one of the chords holding mastership over the human heart and feelings, that the tottering child and the snowy-headed old man, the religionist, and the scoffer, the churchman and the sectarian, alike pay the tribute of admiration to the beauty of form of the Church spires built by our forefathers on principles the mechanism of which, perhaps, they cannot understand, and from feelings, which though some of them cannot possess, yet cannot but revere.

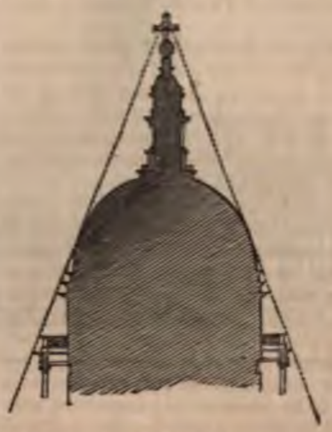
But the truth is, the myriads of these glorious outward church adornments which told at every step the alien as he came to Europe, in this land Christ is great, now deemed useless though sublime, employed industriously and profitably that portion of our Christian population which from the want of employment now begs or tenants the workhouse and the gaol.

No object exists more sublime than the steeple of St. Peters' Church at Caen, unless it be that of St. Michael's Church at Coventry, —none more sublime than St. Michael's, unless it be that of Louth,—none more sublime than Louth, unless it be that of Chichester Cathedral,—none more sublime than the steeple of Chichester Cathedral, unless it be that of Antwerp Cathedral,—none more so than Antwerp steeple, unless it be that of Strasbourg Cathedral,—none more so than Strasbourgh steeple, unless it be that of Freibourg in the Breisgau,—none more sublime than Freibourg steeple, unless it be that of Salisbury Cathedral, which tapering up to heaven in beauteous proportion till it seems more lofty than it really is, appears as though it had drawn down the very angels to work over its grand and feeling simplicity the gems and embroidery of Paradise itself; and, indeed, the most gorgeous of the English florid works of architecture always retain such a peculiar character of sacredness that they always unfold a truly religious appearance.

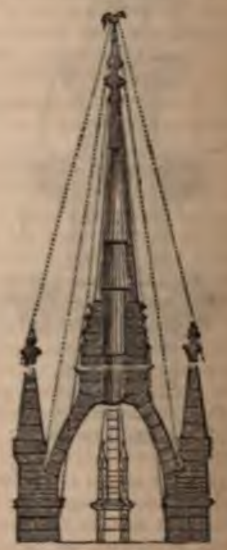
The pyramid is Nature's own form; her mountains, the grandest of earthly masses, diminish to heaven; architectural science requires that a building to endure should end in a pointed summit: a mere heap of sand will by its own gravity assume a pyramidal form, and so endure for thousands of years, and long outlive a wall of granite reared perpendicularly.

The feeling of love for the scientific and picturesque form of the pyramid is so inherent in man, that any modern steeple which is erected, is immediately universally condemned if its outline be not strictly pyramidal, and the most illiterate, who knows not why he condemns it, is strictly correct in his condemnation.

A pyramidal outline is of such importance, that if even a dome do not conform to it, ungraceful clumsiness, and disgust to every class of beholders, are the sure results. In this may be seen the wonderful art of Wren, in proportioning the dome of St. Paul's Cathedral. The cupola is placed a great distance within the tambour, so as at once to suit the particular scheme of its construction, and to form a pyramid.



Outline of St. Paul's Cupola.



Diagonal outline of the spire of St. Dunstan's in the East, London.

---

* We have through the kind permission of the author, taken this paper from a work recently published by him, entitled "Specifications for Practical Architecture; preceded by an Essay on the decline of excellence in the Structure and in the Science of Modern English Buildings."

De Quincy says it appears very harmonious, notwithstanding this peculiarity; but the truth is, that the perfection of its form emanates from this diminution. Indeed, many of the modern cupolas built by Sir John Soane and others, being almost as large in diameter as their tambours, show as little mastery of the picturesque as of construction, and violating the principles of *natural* taste, have become so unpopular as to have obtained for themselves the cognomen of 'Pepper-boxes;' and the same title, but too often applies to bad copies of the ogive domes of King's College Chapel, from their not being built with the graceful and spiring elegance of their prototypes.

The principle of the picturesque in architecture, absolutely requires that if a mass have not a plain square outline, it should appear to be hewn out of an exact pyramidal or conical block.

The principle appears to have been first discovered in Egypt, and to have spread over all nations from China to the farthest extremity of Europe.

The same principle pervades the Egyptian pyramid, the Egyptian needle, and those vast moles of masonry which ascend to an enormous elevation before the Egyptian temples: it pervades the Grecian and the Roman Temple, the Athenian Choragic monument, the Pagoda of China, the mysterious edifices of Mexico, the temple of ancient Hindoostan, the Mosque and the Tomb of the Moslem, and the Christian steeple.

The Greeks, whose several states were inconsiderable, and therefore incapable of raising such ample funds as powerful kingdoms like ancient Egypt or modern Britain, never erected buildings which were not small and low; most of their edifices, therefore, not breaking above the general altitude of their dwellings, they did not require that strict attention to perfect pyramidal outline which was always attended to in the lofty buildings of other nations. They made no advances whatever in the more lofty departments of science which were requisite, and which were of necessity called into use in the construction of such gigantic edifices, they contented themselves with a mere triangular façade.

Both Greeks and Romans, however, appear to have been well aware of the upward diminution requisite in order to correct the otherwise overhanging appearance of the upper part of a building, whether from optical illusion, or from the projection of a cornice; hence we find many of their finest edifices were formed with the plain faces of their architraves receding, as if to continue the upward diminution of their columns. But the proper display of sculpture in the Frieze of an order, in general forbade that member to recede, except in small buildings, such as the Choragic monuments of Lysicrates and Thrasyllus, which were fully taken into the eye at one view. Of the following ancient buildings the faces of the architraves recede: at Athens, the Parthenon, the temples of Theseus and Erectheus, and the arch of Adrian,—at Salonica, the 'Incantada,'—at Rome, the external and internal orders of the Panthenon, the temples of Jupiter-Tonans and Bacchus, the reputed frontispiece of Nero, the reputed temple of Pallas in the forum of Nerva, the arch of Constantine, and the Ionic and Composite orders of the Coliseum: at Tivoli, the reputed Temple of Vesta: all these examples show the possession of the same knowledge, but different degrees of skill in making use of it; and there is at Agrigentum a remarkable monument, shown by Mr. Wilkins in his 'Magna Græca,' the order, entablature, and other members of which, all converge upwardly in a very peculiar manner, not altogether unlike some of the spires of Norman architecture, as at Rochester Cathedral. This structure is reputed to be the tomb of Theron, Tyrant of Agrigentum.

In buildings to be viewed from a great distance, the great art consists in making them appear pleasing from every point of view. Wren was in this as great a master as in geometry and construction: not only do his steeples bear the test in a front view; but when viewed diagonally and in various other ways they still conform to pyramidal outlines whether passed down their utmost breadth, or through the distended open parts of them which appear in a side view.

How ill the moderns have succeeded in steeple building by piling one discordant heap upon another, may be gathered from the almost universal contempt with which the architect, the architectural critic, and the public in general, view our modern steeples: to raise upon each other, to coarse broken outlines, imitations of delicate small works of ancient architecture which stood on the ground, cannot satisfy the mind or the eye: these things all require to be designed on purpose: the higher the stages of the work ascend they are more and more restricted in general magnitude by the outlines of the pyramid, yet from their superior altitude they require to be designed in a larger and simpler style, otherwise, not being read by the eye, they become confused and thence tasteless. The steeple of the new church at Shadwell, from being formed with a good outline, has received almost general praise, although its details are coarse and its materials are mean and fragile: the easy labour of drawing two pencil boundary lines, meeting at its summit, gained for its designer this praise, and saved him from the reprehension given to many works, the details of which would rank higher if placed in proper situations. The author always knew that good steeples were formed on this principle, and he has been much pleased by finding the boundary lines remaining in pencil upon ancient drawings of them.

ARCHITECTURAL COMPETITION.

Sir—I admire exceedingly the bitter complaints which the members of the profession never cease to pour forth, upon the manifold wrongs and indignities to which they are exposed in architectural competitions—as if the fault were attributable to any one but themselves.

I am not going to waste the time of your readers upon any new version of the lamentations of the architects—they may be heard wherever architects most do congregate, and will continue to be heard until the profession take the remedy for their grievances into their own hands, a course they have never yet attempted to any good purpose, because they have never attempted it in earnest. The Institute of British Architects, indeed, have published a report in which they profess to denounce the present system of competition, but they roar you as gently as any sucking dove. They are polite enough to assume that if any unfairness ever attaches itself to competitions, it is only now and then by mistake. They make no endeavour to fix the position of the profession with regard to the competition-monger, and they shrink from the only probable remedy for injustice on the one side, and meanness on the other—exposure. If the profession really seek for justice in competitions, let them ascertain their due and demand it, let them sift every unsatisfactory proceeding and expose it, regardless of the regulation sneer at "disappointed candidates," and let them, O let them acquire a little honest pride, and not persist in snapping at every paltry bait dangled before them, without even a decent concealment of the hook.

In the mean time, until the profession think it worth while to rouse and shake themselves, it may be of some use to collect *facts*, and a pretty collection we might have if every one would but speak out who could. I consider the profession greatly indebted to Messrs. Wyatt and Brandon for the example they set of this course of proceeding in your number for February last, but it is most discouraging that so long an interval should have elapsed without any one having stepped forward to second these gentlemen. I now offer myself in the absence of a better supporter, and beg the favour of you to afford me a place in your pages.

In the month of October, 1839, the following letter was issued:—

Bury St. Edmund's, 29th October, 1839.

"Sir—The subscribers to a new Church to be built in Bury, having agreed to propose to six architects to give designs and estimates of the building, beg respectfully to invite you to do so, and to call your attention to the general nature of the building they require, and to the mode of proceeding which they intend to adopt. The subscribers wish that the church be capable of containing 800 persons upon the floor of it, with an end gallery to contain not less than 150; provision also to be made for side galleries if it shall be found expedient at any time to erect them. That it be faced with white Woolpit bricks with stone quoins, and they wish the architect to specify the materials proposed to be used in the several parts of the fabric, the thickness of the walls, the dimensions of the timbers, and the mode of fitting up the interior.

"The expense of the whole work, after being completed in every respect, must not exceed the sum of £3000.

"Upon the receipt of the designs and estimates from the six architects, the subscribers will arrange the designs in the order which they shall consider the order of merit, and their adaptation to the peculiar circumstances of the case, marking that which they shall most approve No. 1, the next No. 2, and so on. If the subscribers shall think fit themselves to employ a builder to erect the church according to the design No. 1, the architect who has supplied such design shall provide all the necessary specifications and working drawings, and shall employ and pay a clerk of the works, who shall be constantly on the spot, and the architect himself shall as often as may be necessary visit the building, and direct and superintend the work himself, being allowed for the designs, specifications, and working drawings; for his time, trouble and services,—for his journeys, and other expenses, and for the wages of the Clerk of the Works, ten per cent. upon the sum for which the builder shall have contracted to complete the church.—]

"If the subscribers shall call upon the person whose design shall be marked No. 1, to carry it into effect, he shall give security for the execution of his design within   months, making the church complete both externally and internally for the sum at which he may have estimated the cost,—such sum not to exceed £3000, and in this case the subscribers will appoint and pay their own surveyor; and an addition of 5 per cent. as architect's commission.

"In case of failure to give such security as may be satisfactory to the subscribers, if called upon by them to do so; he shall have no claim of any kind upon them for any payment or remuneration whatever, and they shall be at liberty to carry into effect any other plan they may select.

"[The subscribers will present to the gentleman whose design is marked No. 2, £15, and to No. 3, £10.

"Should you, Sir, be desirous upon these terms to send a design, &c., for the Church, you will be pleased to inform the subscribers of your intention to do so, by a letter addressed to me on or before the 30th of November next, and you will send the designs and estimates to me on or before the 30th of December next.

"I am, Sir, your's, obediently,
JAMES SPARKE, Hon. Sec."

"P.S.—The architect is requested to conform as nearly as may be in the details of the work, to the printed instructions of the Incorporated Society for promoting the building, &c. of Churches."

I wish to lay the facts of this case before the public with as few remarks upon them as possible, but it is necessary here to observe, that it has been stated, by way of apology for the most offensive clauses in this most offensive letter, that they were considered requisite in order to protect the subscribers against a fraud to which other parties, in similar circumstances, had been recently exposed, by a notorious falsification of estimates—but this excuse can by no means be admitted. The subscribers* selected the competitors, and were not justified in assuming that all architects are of the stamp alluded to. I should like to ask the respectable legal gentleman who signs this document on behalf of the subscribers, (begging his pardon for using the *argumentum ad hominem*,) how he would like to be sorted with such vermin as might be raked out of *his* profession?

Whatever opinion the subscribers may have thought fit to hold concerning the parties to whom this letter was addressed, it is certain that the terms it offered were peremptorily rejected by the majority, or by the whole of them for any thing I know to the contrary. It may be presumed, also, that somebody took the trouble to enlighten the subscribers upon some little miscalculations into which they had fallen with regard to the sort of building which £3000 might be expected to produce, since they shortly favoured the same parties with two other letters.

The first of these communications, dated the 18th Nov. 1839, is nearly word for word the same as that dated in October, to the end of the passage marked]. It then proceeds as follows:—

"*If the subscribers shall be unable to find a respectable builder willing to execute the design of any architect for the sum of £3000, such architect shall have no claim of any kind upon the subscribers for any payment or remuneration whatever, and they shall be at liberty to carry into effect any other design they may think fit to select.*

"The plans to be drawn to the scale of ⅛ of an inch to a foot.

"No colouring or shading to any of the drawings except the plans and sections.

"No perspective views will be admitted.

"One-third of the sittings in the body of the church to be in pews 2 ft. 10 in. by 1 ft. 8 in.

"One-third in pews 2 ft. 7 in. by 1 ft. 7 in.

"One-third ditto 2 ft. 6 in. by 1 ft. 6 in.

"The west gallery to be fitted up with open seats with back rails."

The letter then concluded as before from the passage marked [to the end. To the postcript was added,

"Your opinion is requested whether it is desirable that any part of the timber be Kyanized, and if so, what part?

"Your opinion is requested whether 800 persons be too great a number to be accommodated on the floor of the Church, considering that £3000 is the sum to be expended on the whole building, which it is wished to be of an ecclesiastical character, though not of a rich or highly ornamented style."

The last is as follows:—

"*Bury St. Edmund's, Nov.* 30, 1839.

"SIR—I have to inform you of the alterations the subscribers have determined upon, and shall feel obliged by your attention thereto.

"To contain 650 on the ground floor.

"The West gallery 200 children, and a staircase at each end, to be serviceable for the side galleries when built.

"A Tower is indispensable.

"£3000 to be expended on the building exclusive of architect's commission, and of any drawback for duty on the materials.

"Pulpit and desk to be included, but not the furniture of the Church, enclosure of same, or bells.

"The price of Woolpit bricks is about £3 per thousand delivered, but it is presumed allowance will be made for duty.

"It is guaranteed that the building shall be open for public competition.

"The question of Kyanizing is left open.

"Colouring of the elevation to be allowed.

"I am, &c.
"JAMES SPARKE, Hon Sec."

Upon the faith of the conditions set forth in these three letters, five designs were sent in, three of them by members of the Institute of British Architects. How these gentlemen reconciled it to themselves or to the principles laid down in the report on competitions published in their name, and deal on any terms with parties who had shown by their first letter the sort of *temper* in which they might be expected to meet the competitors, and so gross a misapprehension of the practice and duties of their profession, is best known to themselves. Perhaps they imagined that the passage in italics, in the second letter, was inserted for the purpose of being acted upon, and if so, they are greatly to be commended for the purity of their minds. The other two designs were by gentlemen not known as architects to the profession in London, and these two were the designs preferred. And not without reason; that selected as No. 1, presented the striking feature of *a spire one hundred and sixty feet high*, and was not adopted without certain reflections, anything but flattering, upon the incompetency of the "London Architects," none of whom had been able to produce any thing to compare with it.

Having selected the design, the subscribers proceeded to receive tenders for its execution; but it having been whispered that the estimates of the builders greatly exceeded the stipulated sum, the result was—not that the subscribers rejected the design and chose another—but that the tenders were returned to the builders unopened, and the design referred back to the architect, for the purpose of being altered so as to bring it within the means of the subscribers. Certain alterations having been effected, tenders were received a second time, a contract was made, and the building is now in progress. How the subscribers have fulfilled the conditions they dictated, may be seen by the following statement:

The accepted tender amounted to £3550 (in round numbers).

In addition to this, extra foundations, to the amount of £150 to £200, were found to be necessary, not in consequence of any unforeseen difficulty, such as might arise from the nature of the soil, but because it was discovered that the section, (a copy of which lies before me,) represented the foundations to be *one foot below the surface of the ground!*

The cost of the building is therefore to be from £3,700 to £3,750; nor is this all, for neither plastering nor painting are included in the contract.

Instead of 650 sittings in pews on the ground floor, there are but 360; 180 more are in open seats, and the remainder on benches.

Instead of stone quoins there is not an atom of stone in the building but what may be indispensable. The window jambs, &c., are of moulded brick, not gauged brick, gentle reader, but bricks from the kiln, with good ⅜ joints between them.

The side walls are 2½ bricks thick, but, to save materials, are built *hollow*, the construction of the rest of the building being in strict keeping; the side roofs are to be covered with zinc. Whether all this is quite acting up either to the letter or the spirit of the instructions of the Incorporated Society, may admit of a doubt at least; also whether a building with bare walls of ordinary brick, and fittings of naked deal inside, can be exactly said to maintain an ecclesiastical character.

Now these be truths. I offer no commentary upon them, for the case is neither sufficiently novel nor peculiar to call for it. If any thing should be mis-stated, I hope somebody better informed will be so obliging as to correct it, and I am sure your columns will be open, either for that purpose, or for an explanation of the proceedings of the subscribers, which I should exceedingly like to see, that is to say, made upon honourable and equitable grounds. The misfortune is, (to drop now the particular case and pursue the question generally,) that subscribers and committees, possessing the privilege of impersonality, and, as Lord Erskine once said of a corporation, having neither a body to be kicked nor a soul to be d——d, are apt to consider that they have fulfilled every obligation incumbent upon them, when they have squared their moral sense by the LAW—and who is to blame them? They have a right to suppose that the architects, in a matter in which they are so much interested, are as well informed both upon the law and the practice as themselves, and content to abide by both, since they send their designs. Lest, however, any professional gentleman should chance to be in ignorance of his legal position, or should be tempted to plead it in extenuation of having offered his back to the saddle, I beg leave to make public the following case and opinion for the benefit of all whom it may concern, and especially of the architectural profession, to whom it is dedicated with the profoundest sentiments of regard.

---

* I beg to observe, that the term "subscribers" is used throughout in the same sense in which it is used by the Hon. Sec. Mr. Sparke, and in no other. The business was of course conducted by a Committee.

CASE.

Six architects were invited to offer designs and estimates for building a new church. The conditions proposed by the parties making the application are, that the cost of the church shall not exceed £3000, and that it shall be sufficiently capacious to seat 650 persons in pews of given dimensions on the ground floor, and certain other requisitions, and they engage to employ the architect whose design shall be most approved.

From the designs sent in to the parties in consequence of this application, one is selected by them which they consider the best; but the cost of carrying this design into execution will be £3750, and only a part of the sittings is provided for in pews of the required dimensions, the remainder being on benches occupying less space.

It is to be observed, that in the present day it is a common practice to invite architects to make designs, &c., for public buildings, on terms similar to those here stated, and architects of the first eminence have tendered designs accordingly.

In making a design for a particular building, conformable with certain stipulations, and to be limited to a certain cost, an architect has to bestow much careful consideration, in order to make the accommodation required as complete as possible, and, whilst employing the cost to the best advantage, not to exceed it. To effect this, he is obliged to curtail embellishments, which he otherwise might have considered desirable: but another, not restraining himself by the stipulations or the limited cost, makes a design much more ornamental and likely to be accepted. The one who faithfully follows his instructions is, therefore, unfairly treated if the parties who lay down the instructions do not themselves act upon them in making their selection.

In this present case, the design which will cost £3750 in its erection, will have less area than one in which all the seats were to be in pews, and consequently, not only the extra £750, but also the difference in the quantity of building tend to increase an outlay in the decoration, which it could not have had if the author had followed the instructions issued to the candidates. Besides this, the design varies considerably in other particulars from the written instructions.

Mr. Serjeant Talfourd's opinion is requested.

1st. Whether this application to the six architects created an implied contract on the part of those who made it, that if the architects would send in designs, they would select from them one which could be built for £3000, and which should be conformable with the instructions?

2nd. Whether the parties, having selected one which they are carrying into execution at a cost of £3750, and which is not conformable with the instructions in various particulars, are not liable to the other architects to remunerate them for their professional labours?

3rd. Whether such liability to remunerate would depend upon the other architects being able to prove that their designs could be severally executed for the £3000, and were conformable with the instructions?

OPINION.

Although the application to the six architects created an honourable obligation to accept the design of one in accordance with its terms, I regret to be compelled to express my opinion that it did not create an implied contract binding in point of law, and capable of being enforced by action. Regarded as a several contract with *each*, its enforcement would be attended with this difficulty, that no one could prove that *his* plan would have been accepted, if the other plan had not been preferred, without which *he* could show no damage—and if regarded as a joint contract, it must include as a complaining party the architect *preferred*, who has no grievance, and will not of course join in complaining of his own success.

2nd. Unless there is some evidence, whence it can be inferred, that the architects were entitled to expect remuneration in the event which has happened, beyond the mere invitation, I am of opinion that they cannot make any legal claim for payment in respect of exertions, which have been rendered abortive by the bad faith of the proposers.

3rd. Supposing any claim to remuneration existing, as it could only be founded on the failure of the parties inviting the plans to perform the terms of their proposal, it is clear that it must depend upon the ability of the claimant to show his own compliance with those terms. But, for the reason already given, I think the claim, even if made by an architect who is able to prove that his design was within the estimate, and conformable to the instructions, cannot be supported.

(Signed) T. N. TALFOURD.

August 15, 1840.

I have nothing more to add except that I inclose my name and address in case any thing in this communication should be construed into a personality.

I am, Sir, your most obedient servant,

K. P. S.

Sept. 15, 1840.

CANDIDUS'S NOTE-BOOK.

FASCICULUS XIX.

> "I must have liberty
> Withal, as large a charter as the winds,
> To blow on whom I please."

I. IN an article on the Fine Arts in Scotland, (Edinburgh Monthly Review, vol. 5,) the writer says, with reference to some of the recent buildings: "although we cannot but applaud the public spirit with which these undertakings have been projected, we are compelled to speak in less favourable terms of the taste which they display. It unfortunately happens that some of them which offend us most, occupy very conspicuous stations, namely, Nelson's Monument, the new Jail, and the new buildings on the North Bridge; to which, were we to enter into a minute examination, we should feel ourselves under the necessity of making sundry serious objections. But we prefer *to draw a veil* over the subject, sincerely wishing that the next undertakings of this kind may be conducted with more judgment and in better taste."—This is certainly the very pink of good nature in criticism, but as for the judgment displayed in it—it would not be amiss *to draw a veil* over that also. To be sure, the passage just quoted, sounds very prettily, and bespeaks a delicate forbearance on the part of criticism, well calculated to render its writer popular with those who expected a castigation from it. Yet if we *draw aside* the *flimsy veil* of words, what is the writer's naked meaning?—why this: he is perfectly aware that reproof is richly merited, yet instead of showing up the offenders, he prefers *screening* them; instead of holding up errors and blunders, and failures, by way of wholesome warning for the future,—which, perhaps, he felt would be venturing beyond his depth,—he contents himself, good, easy creature, with "sincerely wishing that the next undertakings of this kind may be conducted with more judgment and on better taste"!—which amiable phrase may be handed down to the very end of the chapter of architectural blunders and failures. Really I prefer the motto of "Old Blue and Brimstone," Judex damnatur cum *nocens* absolvitur; and I'm sure there is *no-sense* or nonsense enough in some one of the works mentioned in the paper referred to.

II. Let us, however, try another slice of it. "In examining the various public buildings which have been erected in Edinburgh, within the last forty years, no very favourable view of the progress of our taste is afforded in the circumstance of the first in point of time, namely, the Register Office, being so much superior in design to those which have followed it; and the recent improvements betraying, while they profess to be formed on the style of the ancients, a strange neglect of the principles of composition, and even of the details which come within the grasp of ordinary talent." This is well observed, and if for 'Edinburgh,' we substitute the word 'London,' all the rest will still hold good. Yes we have imitated the ancients after a very strange fashion indeed, or rather have deluded ourselves into the notion that we were actually running a race with them, while we were only hobbling after them on classical crutches. Which reminds me of what was once said to one of the Servum Pecus who piqued himself on his classical exactness: your portico may, as you observe, be *after* the Parthenon, but it lags a confounded way *behind* it."

III. The next slice of this criticism may not be to every one's taste—more likely, perhaps, to turn some folks' stomachs: "We have also to regret the *mania nows so prevalent for the Gothic style*, which we cannot help thinking to be inconsistent in every respect, with the manners and the means of the age, and with the great principles of beauty which have been recognized in civilized Europe, as the basis of excellence in architectural composition,"—For this opinion we consign the writer over to Welby Pugin, he being one of those who are desperately far gone indeed in the Gothic *mania*, and therefore likely to take the writer to task to some purpose.

IV. Perhaps John Britton may fall foul upon the writer ... for some [illegible] in his "Modern Athens," that at Edinburgh "public and private edifices of the most splendid description meet us at every glance" [illegible]; there is nothing whatever in his book to confirm—or even give decent colouring to that piece of puff. He assures us, indeed, that that most [illegible] lowly building the new Edinburgh Academy, is "a handsome structure, [illegible] by a beautiful portico supported by Grecian Doric columns." But such handsome structures and such "beautiful porticoes" are almost enough to make us sicken at the very name of architecture. At recounting them, one is tempted to pray that an earthquake may swallow them up,—and yet after praising that [illegible], Britton actually censured the poor Queen as the subject of Buckingham Palace,—though he had previously spoken of it as something prodigiously grand.

V. By very far the greater part of Edinburgh architecture, as regards modern buildings, is even when not remarkable for positive faults, of that provokingly insipid, dull, cold, tame sort, as to be utterly valueless in regard to æsthetic quality. When you have said that the builders employ stone instead of brick and cement, you have gone to the utmost extent of the eulogium they merit. As to architectural property or talent, the vertical profile is a perfect desert; and should the grave folk of Auld Reekie take this character of it in dudgeon, they ought at least to keep some of their anger for themselves; for if they have not thought it worth while at the time to produce something really deserving praise, they ought not now to be scandalized at finding themselves reproached with want of taste. At all events they may feast upon the flowery flummery with which a certain Doctor has fussed them,—to wit, Dibdin, describing Edinburgh as "a city of palaces, the *Genoa of the North*." Surely there, the Doctor drew most largely upon his imagination: or else must have mistaken some architectural mirage for a reality, and the plain humdrum buildings around him for so many palaces, after the same fashion that Don Quixote mistook the frowsy Maritornes for a lovely princess.—Happy mortals those who like the Don and the Doctor can conjure up princesses and palaces as they please!

VI. "I do not understand what you mean by Feeling: what has feeling to do with architecture?" This was once said to me by one who was by no means the greatest dunce in his profession: whereupon I was tempted almost to reply: "If you rap that thick head of yours against the wall, you will perhaps understand what feeling is—I mean the only kind of it you are capable of comprehending."

VII. "Effect" is another word that seems banished from the architect's vocabulary: or if the term be occasionally employed, that which it expresses is very rarely considered or aimed at. Instead of being studied and purposely introduced, it appears rather to be shunned. Not but that I have seen effects and singularly striking and beautiful ones too. No thanks for them, however, to the architect; for I have almost invariably found that the most beautiful effects of all, have been entirely the result of sheer accident; and never anything aimed before-hand in the design; and further, that where any originality of plan has been adopted—any deviation from the wearisome sameness and insipidity which prevail in the forms and arrangement of rooms, it has in almost every instance been occasioned by some peculiar and awkward circumstance in the building that has compelled the architect to fling away his accustomed dream recipes and prescriptions, and resort to some expedient and contrivance—out of the ready "cut and dried" school, therefore, I suppose, [illegible]—and to be more or less original in spite of himself.—It was a marvellous mercy for Sir Jeffry Wyatville that, instead of being ordered to raze Windsor Castle to the ground, and prepare an entirely new plan, he was left to contend with the difficulties imposed by the old one. The consequence is that there are now many piquant parts in the interior, and much variety in the plan, that would else, in all probability, not have occurred.

VIII. It would not be amiss if, instead of proposing as architectural prize-subjects to students such high-flown things as palaces, and senate houses, which are not wanted, the Academy were to require of them ideas, for that which none of our palace-builders have been able to design—to wit, a sentry-box. Those at Windsor Castle and Buckingham Palace, are most beggarly things, literally wooden boxes, not only homely in material, but barbarous in taste. Surely if it were worth while to erect a marble arch before the palace in St. James' Park, it would also have been worth while to erect sentry-boxes that should accord with it: whether they were detached from the arch itself, or made to form part of its design. The perversity of taste displayed in such matters is all the more unaccountable, because one seldom finds similar contrasts of shabbiness and finery in any others. One does not see common earthenware and plate on the same table, or deal chairs and rosewood tables in the same room.—I should certainly like to be informed, wherefore, if there must be sentry-boxes at all in front of a palace, they must invariably be shabby eyesores. Yet, I believe, I might inquire for some time before any one could give me a satisfactory reason. It might possibly be alleged that it would be quite infra dig for any architect to attempt to design aught of the kind. Nevertheless I apprehend that a Greek architect would not have scrupled to do so, or have thought it derogatory either to his talent or his art to invest even a sentry-box—if there was occasion for one, with elegance of form. Nay, do we not find among the structures of Athens itself, one that affords a very strong hint—almost a direct model, for such purpose? Would not that example be more consistently adopted by being so transformed than after the manner in which we now repeat it [illegible], without any modification to adapt it for the modern application of it? Scarcely shall I be asked what is the example I allude to, for no doubt, every one will now instantly discover it. As for those who cannot, it matters little to them whether I say what it is now, or a month hence. I am therefore determined not to satisfy their curiosity this time.

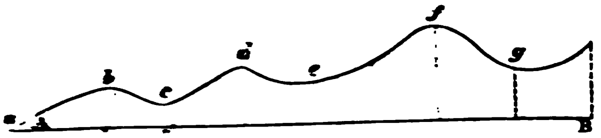
ON THE METHODS OF COMPUTING THE QUANTITIES OF EARTHWORK IN CUTTINGS AND EMBANKMENTS.

By S. Hughes, C.E.

Although the prismoidal formula of Dr. Hutton, by means of which are found the contents of the figures composing cuttings and embankments, is now well understood, and although great facilities for computing these contents are given by Mr. Macneil's tables, and by a tabular sheet more lately published by Mr. Bidder, yet it seems that a ready method of calculating separately the slopes, and the middle part of the excavation or embankment is still wanting.

Mr. Macneil has one table in his book giving areas for a base of 1, and a slope of 1 to 1, from which by simple multiplication the contents for any slope and for any base may be found. Mr. Bidder's table also gives the contents for slopes of 1 to 1, and base of 1, but for lengths of one chain or 22 yards. These tables are useful only for calculating sections where the scale is very small, and where the heights cannot be taken otherwise than in feet, because the tables are only computed for whole numbers. In the process of calculating from working sections however, where the scale is sufficiently large to show the heights in feet, and decimals of a foot, the tables will be of no use, and the following simple formulæ derived from that of Dr. Hutton, mentioned above, are intended to supply the deficiency of more extensive tables, and it is believed they may be used with so much ease as entirely to supersede the use of any tables.

Fig. 1.



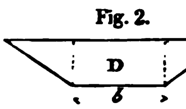
Let a b c d be the longitudinal section of a cutting, from which it is required to find the contents down to the line A B.

The surface line should first be divided into straight portions, and vertical lines drawn from each point of division to the line A B. Then the contents of all the spaces into which these lines divide the section being added into one sum, will be the content of the whole cutting. It is required therefore, independently of tables, to adopt a ready method of ascertaining the cubical capacity of a portion of the cutting whose vertical area is represented by one of the before mentioned spaces, as $b\,b'\,c\,c'$.

For this purpose let the two depths of the cutting at the greater and smaller ends, or $b\,b'$, $c\,c'$, be respectively $= D$ and d; let the breadth be $= b$, the ratio of slopes $= r$, and the distance between the two ends $= l$.

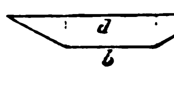
The area of this piece of cutting at the greater end will be

Fig. 2.



And at the smaller end

Fig. 3.



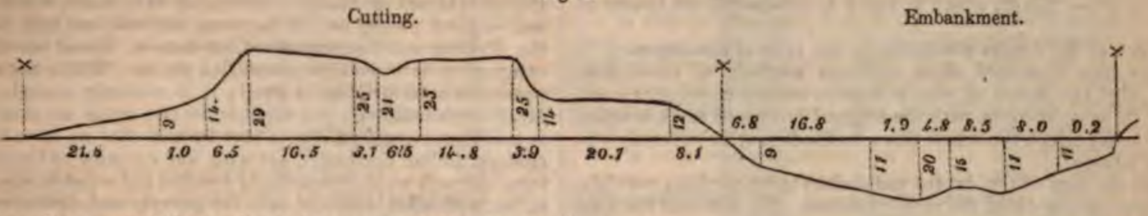
so that the solid figure comprised between these two end areas is composed of a middle part or core which is the frustrum of a wedge, and of two side pieces, which together form the frustrum of a pyramid. It is evident that the content of the core is simply $l\,b.\frac{D+d}{2}$ and by the prismoidal formula the content of the side pieces is also readily found $= l.\,\dfrac{D^2 r + d^2 r + 4\,\dfrac{(D^2 r + d^2 r + 2\,r\,D\,d)}{4}}{6}$

which reduced becomes $= l.\,\frac{r}{3}\,(D^2 + d^2 + D\,d)$.

This expression appears to be so simple as scarcely to require any table by way of aid in the calculation. It is obvious, however, that the only table which can at all be necessary in using this method of computing sections is one of squares, such as may be found in the Engineer's Pocket Book, and many other works of reference.

The following example will show the manner in which the formulæ should be used.

Fig. 4.



Let the above be a part of the section to be computed then the calculation will be as under.

EXCAVATION, No. 1.

Lengths in chains.	Depths in feet.		Middle $(D+d)\,l$	Sides $l\,(D^2+d^2+D\,d)$
21·5	0	9	193·5	1741
7·0	9	14	161·	2821
6·5	14	29	279·5	9380
16·3	29	25	880·2	35713
3·7	25	21	170·2	5887
6·5	21	25	299·	10341
14·8	25	25	740·	27750
3·9	25	14	152·1	4567
20·7	14	12	538·2	10516
8·1	12	0	97·2	1166
			3510·9	109882

Middle $3510{\cdot}9 \times \frac{22}{9 \times 2} = 4291$ cube yards for base of 1 foot.

Sides $109882 \times \frac{22}{9 \times 6} = 44767$ cube yards for slopes of ½ to 1.

EMBANKMENT No. 1.

6·8	0	9	61·2	551
16·8	9	17	436·8	8786
7·9	17	20	292·3	8129
4·8	20	15	168·	4440
8·5	15	17	272·	6536
8·0	17	11	224·	4776
9·2	11	6	156·4	2052
			1610·7	35270

Middle $1610{\cdot}7 \times \frac{22}{9 \times 2} = 1969$ cube yards for base of 1 foot.

Sides $35270 \times \frac{22}{9 \times 6} = 14369$ cube yards for slopes of ½ to 1.

Very little explanation will be required to render the preceding calculation understood. It is evident that the multiplication by the fraction $\frac{22}{9\times 2}$ or $\frac{11}{9}$ is necessary (in consequence of the lengths being in chains, and the depths in feet,) to reduce the first results into cube yards.

And it will also be clear that as the numbers in the column headed "sides," are determined without multiplication by the fraction $\frac{r}{3}$, that is for a slope of 3 to 1, the further division by 6 is necessary to reduce them to a slope of ½ to 1. The quantities may be determined with equal readiness for any slope, integral or fractional, by simply multiplying the numbers found as above, by the fraction $\frac{r}{3}$, where r is the rate of slope required.

It will be found extremely convenient for engineers and others consulting the sections of new lines of railways, or comparing together two or more sections of the same line, to know the quantities for different slopes, and these may be readily exhibited by simple addition, thus:

(For a base of 30 *feet.)*

EXCAVATION 1.		EMBANKMENT 1.	
	Cube yards.		Cube yards.
Upright sides.	128,730	Upright sides.	59,070
Slopes of ½ to 1	173,497	Slopes of ½ to 1	73,439
„ 1 to 1	218,264	„ 1 to 1	87,808
„ 1½ to 1	263,031	„ 1½ to 1	102,177
„ 2 to 1	307,798	„ 2 to 1	116,546
„ 2½ to 1	352,565	„ 2½ to 1	130,915
„ 3 to 1	397,332	„ 3 to 1	145,284

It may be useful now to glance at certain erroneous methods of calculating earthwork which were at one time exceedingly prevalent. These methods have often been the occasion of serious loss and disappointment to contractors and others, by some of whom they are not abandoned even at the present day. It will be shown that calculations of earthwork made according to the common erroneous rules may be readily altered so as to give a correct result. Hence the investigation of these errors will furnish us with new and distinct rules for finding the contents of earthwork sections, each rule being correct and giving the same result as the formula already derived.

I. Let it be required to determine the error occasioned by taking the mean of the two *end areas*, and multiplying this mean by the length for the solid contents of a prismoid. This method may be expressed thus:—$l\,\frac{D\,b + D^2 r + d\,b + d^2 r}{2} = l\,b.\,\frac{D+d}{2} + l\,\frac{r}{2}(D^2 + d^2)$ from which it appears that the difference between this and the correct expression exists only in the side pieces, and is equal to $\frac{r}{2}\,(D^2 + d^2) - \frac{r}{3}\,(D^2 + d^2 + D\,d) = \frac{r}{2}\,D^2 + \frac{r}{3}\,d^2 - \frac{r}{3}\,D^2 + \frac{r}{2}\,d^2 + \frac{r}{3}\,D\,d = \frac{3\,r}{6}\,D^2 + \frac{3\,r}{6}\,d^2 - \frac{2\,r}{6}\,D^2 + \frac{2\,r}{6}\,d^2 + \frac{2\,r}{6^2}\,D\,d = \frac{r}{6}\,(D^2 + d - 2\,D\,d)$. Excess above the correct area. Now this excess is equal to *one-sixth* the square of the difference of the depths multiplied by the ratio of the slopes.

II. The other erroneous method is more commonly in practice than the preceding, and gives a result nearer to the correct one, but the difference here is one of defect, not excess, that is on the wrong side for the contractor. According to this method, an area is calculated for the arithmetical mean of the depths, and this area is used as the one which being multiplied by the length, is to give the content of the figure.

Thus $b\frac{\mathrm{D}+d}{2}+r\left(\frac{\mathrm{D}+d}{2}\right)^2$ is the area corresponding to the mean of the depths from which it is seen that the difference here also between this and the correct area exists only in the side pieces. This difference is readily obtained thus: $\frac{r}{3}\mathrm{D}^2+\frac{r}{3}d^2+\frac{r}{3}\mathrm{D}d-\frac{r}{4}\mathrm{D}^2+\frac{r}{4}d^2+\frac{r}{2}\mathrm{D}d=\frac{4r}{12}\mathrm{D}^2+\frac{4r}{12}d^2+\frac{4r}{12}\mathrm{D}d-\frac{3r}{12}\mathrm{D}^2+\frac{3r}{12}d^2+\frac{6r}{12}\mathrm{D}d=\frac{r}{12}(\mathrm{D}^2+d^2-2\,\mathrm{D}\,d)$, which is equal to *one-twelfth* the square of tne difference of the depths multiplied by the ratio of the slopes.

We have now examined three different methods of calculating earthwork, the two latter of which require certain corrections; and combining these corrections with the original erroneous rules, in order to render them perfect, the whole three methods may be correctly expressed as follows.

I. Square the sum of the depths and deduct their product, multiply the remainder by one-third the ratio of slopes. To this add the half sum of the depths multiplied by the breadth.

Or,

II. From the half sum of the two end areas deduct one-sixth the square of the difference of the depths, multiplied by the ratio of the slopes, the remainder is the correct area.

Or,

III. To the area corresponding to the half sum of the depths, add one-twelfth the square of the difference of the depths, multiplied by the ratio of the slopes, the sum is the correct area.

EXAMPLE.

Suppose a piece of cutting or embankment 39·8 feet deep at one end, and 24·6 at the other end, the base or top 30 feet, and slopes 2 to 1, required the area, which being multiplied by the length, shall give the true content.

I.

39·8
24·6

64·4 × 64·4 = 4147·36
39·8 × 24·6 = 979·08

3168.28
2

6336·56
3 | 2112·19
32·2 × 30 = 966

correct area 3078·19

II.

(39·8 × 2 + 30) 39·8 = 4362·08
(24·6 × 2 + 30) 24·6 = 1948·32

2 | 6310·40

3155.20
$\frac{2(39\cdot8-24\cdot6)^2}{6}=$ 77·01

correct area 3078·19

III.

(39·8 + 24·6 + 30) 32·2 = 3039·68
$\frac{2(39\cdot8-24\cdot6)^2}{12}=$ 38·51

correct area 3078·19

The first and third of these methods are recommended to practical men in preference to any of the common tables.

The writer having both calculated himself, and superintended others, while calculating some thousands of miles in length of sections, can speak very positively as to the saving of time which is effected by the simple calculations here pointed out. The mode of applying the first method to extensive sections has been already shown, and the application of the third is equally simple. The labour of calculation is nearly balanced between these two.

12, *University-street, Sept.* 12, 1840.

THE REFORM CLUBHOUSE.

(With 2 Engravings, Plates 16 & 17.)

HARDLY shall we be censured for bestowing farther notice on the exterior of this edifice, because, although the Wood-cut view of it in our May number, served very well to convey a general idea of the design and style of architecture, the details and admeasurements could only be guessed at, whereas it is highly desirable that they should be correctly represented on an intelligible scale, similarly to those given of the Travellers' Club-house in the series of "Studies and Examples of the English School of Architecture." We hope that the last-mentioned building, this new production of Mr. Barry's will be fully illustrated by the same artists: in the mean while we shall show in this and our following number, as much as will enable our readers to understand both the external elevations, and the leading arrangement, &c. of the interior; which last we intend to explain by a Section as well as Ground Plan.

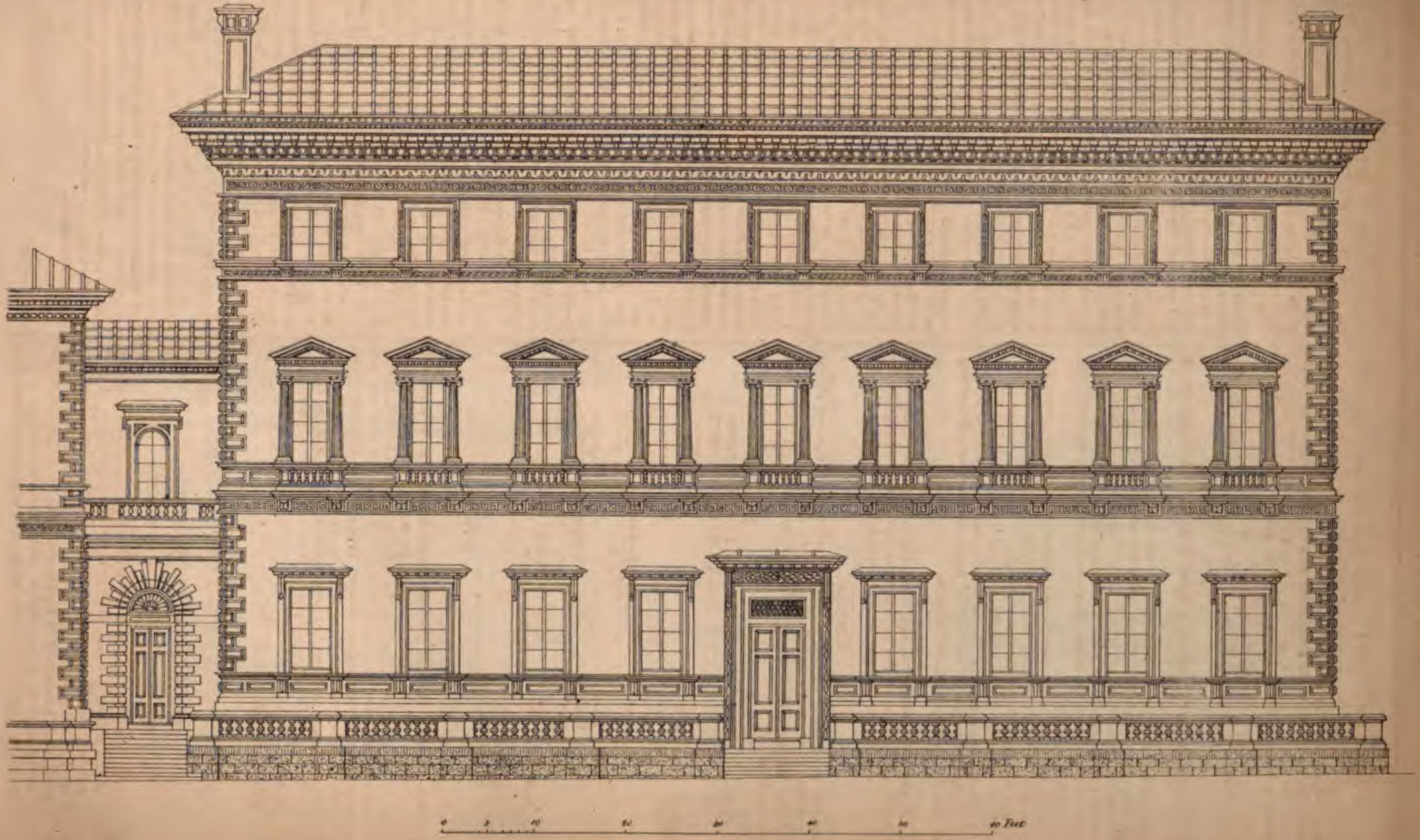
Whether there be any who do not admire this piece of architecture, we cannot positively say; yet if any there are at all, we conceive that they are very few. Neither can we be certain that there are none, who do not regret that the style here adopted is likely to supplant that *pure* Greek architecture which, till very lately, was in such repute and request among us. It happens curiously enough, however, that the Reform and Conservative Club-houses, almost inevitably force a comparison between their respective styles. While the contrast they present is most striking in itself; it is evidently enough, in favour of Mr. Barry's building: yet whether the two styles are thus fairly tested is a different question, for it may be said that we have here the very choicest Italian confronted not with any example of Grecian architecture, nor with what is considered a skilful and artist-like modification of it, but with what exhibits only the poverty and defectiveness of that style without any of its redeeming qualities. At all events, therefore, the admirers of the latter must now be as little satisfied with that specimen of Sir R. Smirke's taste and ideas of classical design, as those who give their unqualified preference to the Italian style. In no respect is the contrast between the two designs more striking than as to those particulars which exhibit similary of purpose in both. In the one case, we perceive that so far from at all detracting from the beauty or character of the rest, the *area* is so treated as to be exceedingly ornamental, and to give additional dignity to the whole design, being enclosed by a terrace-like screen consisting of a balustrade, upon a deep socle of elegant rustic work; while that of the Conservative Club-house is no better than the area of a common house, and the railing is as poor in effect, and as un-Grecian in design, as it was possible to make it. No less strongly marked is the contrast between these two façades as regards the character they derive from their crowning members: though somewhat less plain and scanty than in some other examples of the same school, the entablature and cornice of the Conservative, tame and meagre enough at the best, now appears utterly insignificant in comparison with the cornicione one of its neighbour the Reform Club-house:—which latter may in fact be considered as the entablature to the whole structure, therefore not at all excessive as to bulk. The same remarkable disparity of character pervades the two designs generally: in Sir R. Smirke's building, almost every part is left chillingly bare and poor, and at the best, shows certain Grecian forms stripped of all their beauty, whereas in Mr. Barry's all the lesser members and details, such as string courses, &c. are made to conduce to architectural elegance and expression. The "Conservative" may be compared to a picture mere *dead-coloured*, the "Reform" to one consistently worked up and carefully finished in all its accessories.

If it be objected that the *microstyle* application of columns to the windows of the Reform Club-house, is not strictly legitimate, inasmuch as those parts are thereby converted into mere decorative appendages; we think that so applied they are less faulty than either *microstyle* orders affecting to be somewhat more than decoration, or than such apology for an order as a few large antæ gratuitously stuck on here and there to the front of a building, and which are allowed to contribute as little towards decoration as they do.

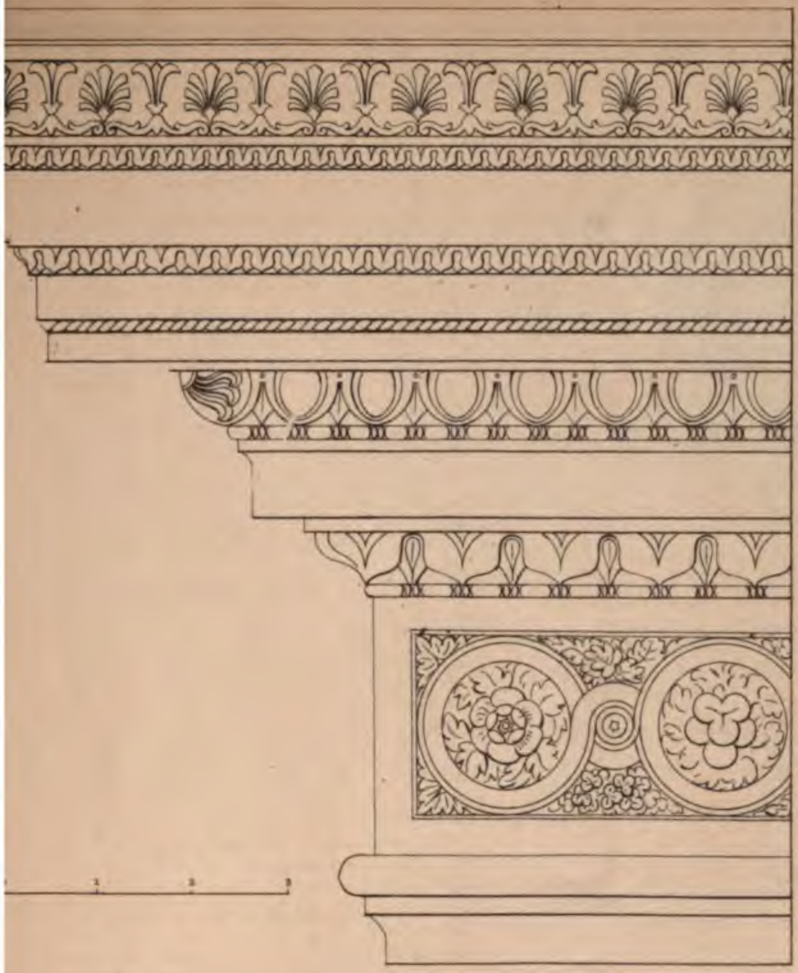
Either Greek architecture does not by any possible modification of it, admit of the variety and richness which the Italian style affords,—at least not where columns are excluded; or else no one has as yet thought it worth while so to mould the former as to render it quite as suitable as the other for buildings of this class. Be that as it may, the example of the Reform Club-house most assuredly is not calculated to obtain much favour for the style of its neighbour; but neither, on the other hand, is it likely to recommend the petty Palladian manner, which has hitherto been generally received as the quintessence of Italian art.

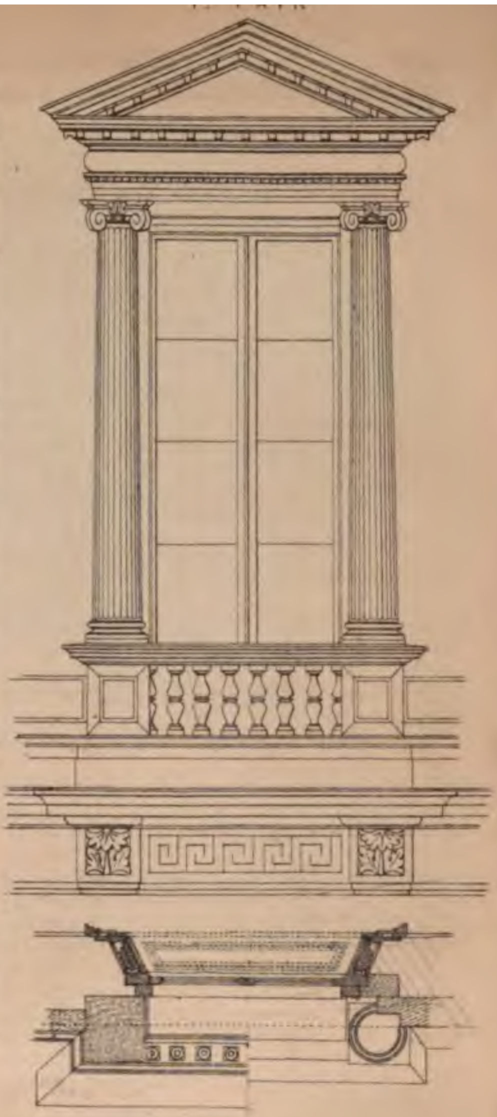
In our account of the interior of Mr. Barry's building we shall have occasion to enter into description, but on the present occasion the elevation given in the plate renders description unnecessary, those of the south and west sides being perfectly similar, except that there the pediments to the windows are alternately segmental and triangular. Besides the elevation, the details of the exterior, viz. Cornicione, windows, &c. are shown in a separate plate, so that the design is perfectly intelligible.

Reform Club House, Charles Barry Esq. Architect.

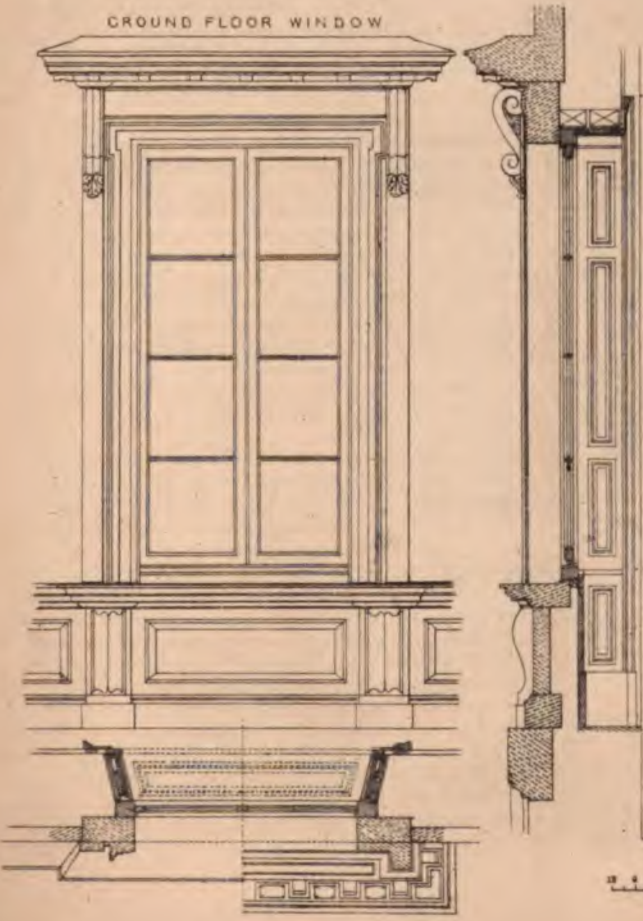


J. R. Jobbins, Draft. & Litho. Warwick Ct. Holborn

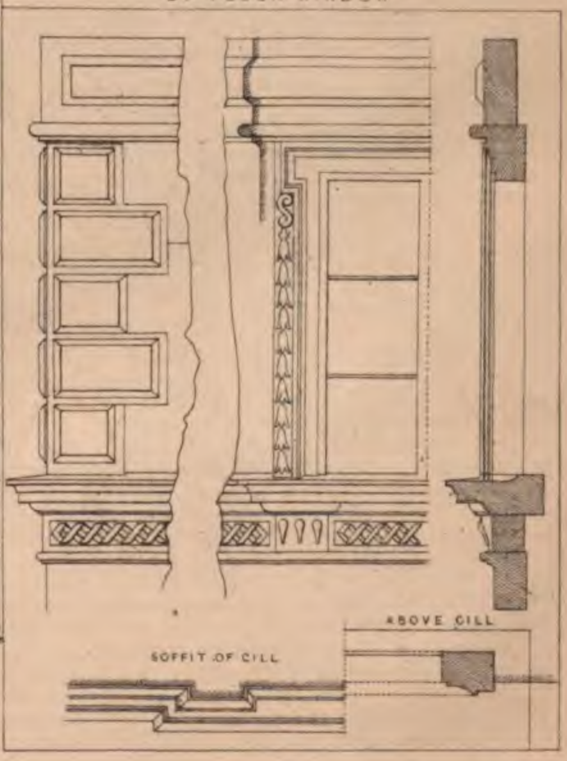


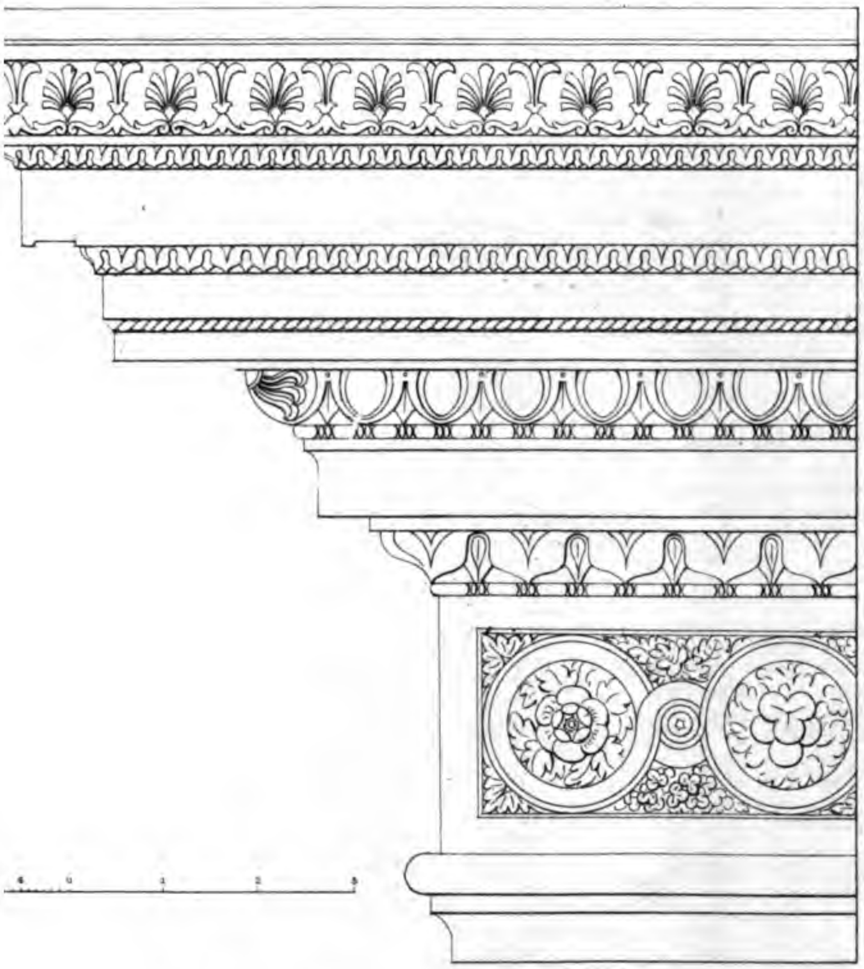


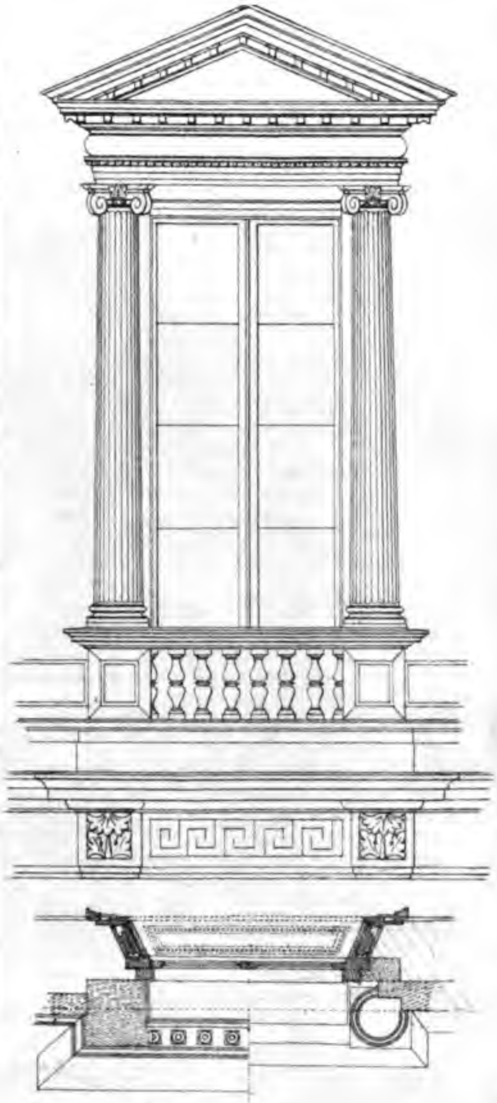
GROUND FLOOR WINDOW



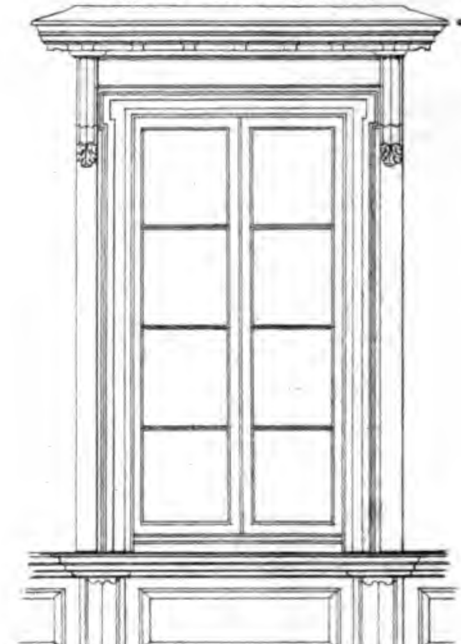
2ND FLOOR WINDOW

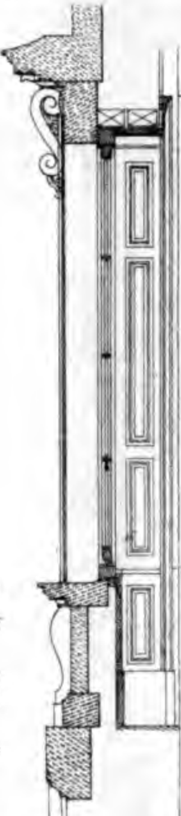




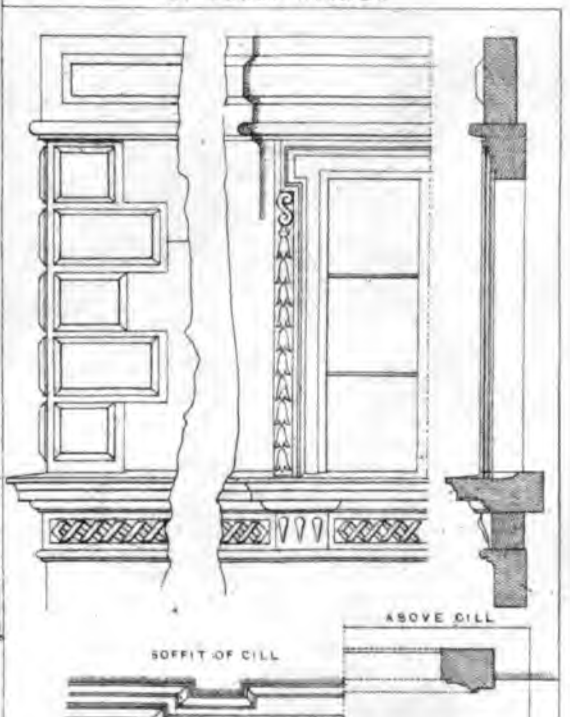


GROUND FLOOR WINDOW





2ND FLOOR WINDOW



ON THE DISTINCTIVE CAUSES WHICH OPERATED IN PROMOTING THE RISE AND PROGRESS OF GREEK AND ROMAN ART.

By Frederick J. Francis, Architect.

Among all those nations the records of whose history reach to the present time, those of Greece and Rome stand out the most conspicuous and illustrious. Every thing which relates to them, is by common consent, invested with a sustained and continuous interest, which the annals of no other countries are able to produce. The very mention of their names calls up in the mind a thousand noble and spirit-moving recollections, the dynasties of the present age seem to shrink abashed, when placed in comparison with their ancient national grandeur; and we have but to let our thoughts sweep in the range of their contemplations, over the successive epochs of their history to discern at one period or another the ascendancy of every thing great or excellent, whether in political constitution—in national and individual virtue—in the refinements of literature, or the peaceful glories of art.

And yet, great—eminently great, as were both those countries in politics, philosophy and art, no one can doubt that the circumstances which attended the highest national altitude of the one nation, were singularly contrasted with those which attended the other. In Greece, as we shall hereafter see more particularly, the period of purest political freedom was contemporaneous with the development of the sublimest philosophy, and the most exalted art: while in Rome, it is unhappily notorious, that at the time when their literature and arts were at their meridian, the subjects of merited astonishment to foreign and surrounding states, extorting the homage, and compelling the admiration of all—the essential freedom of their political system was totally undermined—the roots of that despotism which was subsequently the wreck of every thing illustrious among them, had firmly implanted themselves, and their successes in art did not so much result from the combined efforts of a people collectively imbued with a thorough passion for, and appreciation of, the sublime and beautiful, as from the effects of a few accomplished but tyrannic emperors, who, by means of a gorgeous display of the beauties of art, hoped to blind the once free born citizens of Rome, to the disastrous consequences which must inevitably accrue to the nation, from the establishment of eastern absolutism; and to amuse them with the tinsel trappings of national prosperity, when they were, all the while, forging for them, manacles, the most degrading that ever weighed down the energy, and annihilated the spirit of the noble and the free.

But to confine our remarks strictly to the subject we have undertaken briefly to examine. It will not be imagined from what we have already stated, that there was any similarity in the principles which gave to the arts of the two countries their leading impulse, or contributed to their final success. As there was a great difference in the period, so was there a marked contrast in the causes, immediate as well as secondary, which induced their consummation among the one people and the other: and a steady consideration of this unquestioned fact, will help to make us duly estimate the relative claims of the two to the higher and more illustrious place in our esteem. In both countries we cannot fail to recognise a state of things wherein the arts were loved, cherished and venerated: but still, Greece in the meridian of her arts, under the sway of Pericles, and Rome, correspondently great, under the dominion of Augustus Cæsar, present far more numerous features of contrast, than analogy; the whole current of the public mind of the one nation ran in a different channel from that of the other; and we contemplate with far greater satisfaction the intellectual eminence of the one, than the splendid, but withal treacherous distinctions of the other.

But it will be necessary for the right elucidation of the subject, that we should glance with some minuteness at the various isolated and connected chain of circumstances which attended the rise of Grecian art, in order that it may the more clearly appear that all analogies to it, are wanting in the correspondent progression of art in Rome.

The rise of Grecian art took place under circumstances singularly striking. Like other nations in their infant state, the country of Greece was originally inhabited by a wild race of hardy mountaineers, men to whom the fortresses of nature were dwelling places, and the pursuits of the chase, a subsistence. Gradually consolidating themselves into societies, settled laws took the place of that uncertain authority founded only on might: the savage barbarism of aboriginal life was laid aside, from being predatory wanderers they became civilized settlers; and progressively advanced in mental and moral acquirement. At a very early period of their existence as an independent people, many of the inhabitants emigrated to the neighbouring coasts, and long antecedent to the parent state, reached to great national eminence and distinction.

The great Ionic migration to the fertile and beautiful settlements of Asia Minor, was the most illustrious of them all; and it was among these celebrated and voluptuous colonies that the real and inherent genius of the Grecian people originally manifested itself. Here philosophy, poetry, history and art first found a home; while the parent state had scarcely emerged from the long pupilage of nations, they had attained the summit of their intellectual development, and were even giving unequivocal symptoms of prostration and decline. They struggled and fell, to rise no more; but as if by their dissolution an additional impetus was given to the efforts of continental Greece, it was only subsequent to the protracted war with Persia, which had been the ruin of her colonies, that Athens, the metropolis and heart of Greece, took the van in the department of art; she then vindicated her claim to that superiority which of right belonged to her, as the capital of a free and manly race; and although formerly she had produced no artists, and possessed no genius equal to those Sicyon, Egina, and Miletus, she now as far outstripped them in the peaceful glories of art, as she had done in the deeds of military and naval valour. She soon reached to her proudest intellectual eminence, and under the fostering sway of the renowned Pericles, showed marvellous proofs that the really sublime and beautiful in material objects were thoroughly appreciated and understood.

But here we pause for a moment to mark the causes which induced these extraordinary triumphs. How was it that among these small, independent, and comparatively insignificant states, the human mind, as if relieved from a burden which formerly oppressed it, and visited with an elastic and buoyant energy, previously unknown, should so signally assert its appropriate dignity, and display its brightest efflorescence.

How was it, that although empires, mighty and illustrious, had preceded even the commencement of her national individuality, who had wielded the sceptres of well nigh universal monarchy, and in whose hands were lodged, treasures the most unlimited, they had never evidenced the possession of aught, but a narrow and contracted intellect—had never been able to achieve anything remarkable in the region of intellectual superiority, nor were even at the summit of their glory, a tenth part so really and truly great, as were those comparatively small and insignificant states.

Are we to look at the nations by whom Greece was surrounded, for the germ of that architectural beauty—that sculptural grace—that artistic excellence, which pre-eminently distinguished them? Did they derive from a source extensive to themselves, as we shall presently find to be the case with Rome, those principles of the beautiful and the sublime, which they so exquisitely carried out and acted upon? Was there ought in the arts of Egypt or the Eastern world, which can be referred to, as giving to the gifted children of Greece, any of the original ideas of that mingled grandeur, simplicity and grace, which are acknowledged so thoroughly to pervade their unrivalled productions? We answer, assuredly not. We think it is doing great injustice to the striking originality of the Grecian mind, to contend that as Rome derived her arts from Greece, so Greece derived her arts from Egypt or Asia. There may be, and there doubtless are, distant and obscure analogies between the architecture of the Nile, cumbrous as it was, and the symmetrical productions of Greece; but still, whatever the Greeks borrowed in this branch of art, was only incidental and subordinate, and became so essentially changed by its tranmission, as to well nigh the product of their own independent and unaided genius. And then, whatever differences of opinion may exist upon this point, it must be admitted by all, that in sculpture and painting they owe to the Egyptians, absolutely nothing. Look at the ideal beauty of their immortal creations, that god-like expression of majesty which pervades one—that manly grace, or matronly dignity which distinguishes another; that winning tenderness which beams forth in a third; and in the whole range of either Egyptian or Asiatic art, can there be adduced one single group or figure, by the contemplation of which a Grecian artist might have caught one additional ray of inspiration, or been enabled so to guide his chisel or his pencil as to convey to his works one previously unimagined lineament of grace, expression or beauty. Emphatically we answer, assuredly not. The Egyptians, a severe people—hard as their own granite—only reached a certain point in the region of art, and attained to no progressive and advancing excellence. In their thorough hatred of reform, and scrupulous attachment to the miscalled wisdom of their ancestors, they laid equally an interdict upon novelties in art, as upon novelties in political affairs; and consequently, in architecture, were never able to reach that singular combination of the sublime and beautiful which pervades the works of Greece: in sculpture, were ignorant of that true ideal beauty founded in the abstract upon nature, yet soaring above any individual instance of it: and in painting, they were, we are competently informed, destitute of all knowledge of expression and grace, and the fascinations of varying lights and shadows.

If then the Greeks did not owe the superiority of their attainments in art, to the extrinsic aid of foreign states, if through the entire range of Egyptian and Asiatic productions, we see, speaking comparatively, absolutely nothing of that mingled grandeur, grace and beauty, which is stamped in almost every creation of the pure Greek mind; we are driven to the conclusion that they derived their excellence from their own direct and inherent genius; that they had, what no other nation possessed before, the elements of pure and exalted art, within the precincts of their own national mind: and were able, moreover, to refine and purify all that they saw around them; bringing about, in short, an entirely new epoch in the history of art. It was their leading aim, and they accomplished it, to raise architecture from the unmeaning and the colossal, into the simple, the grand, and the graceful; to transform the emblematic ugliness which pervaded all the efforts of the earlier sculptors, into the beauty and majesty of the perfect ideal; and to transform into the formerly cold and lifeless productions of the Egyptian painters that perfection of form, outline, and expression, which shines forth for instance in the Venus Anadyomene.

Now who does not perceive at once, from this brief detail, that the rise of the arts in Rome, stands remarkably contrasted with that in the country we have been reviewing. Greece, we have seen, was preceded by no people who had any clear or definite conception of what was really and expressively beautiful, and evolved all that we most admire and venerate from the recesses of her own national intellect: Rome, on the contrary, was in the infancy of her existence, while Greece was perfect and efflorescent, and had, in living in the midst of such mental greatness, just that advantage which a gifted individual has, on being born in an age of intellectual eminence.

In the rise of art in Greece, and in the correspondent rise of art in Rome, there is just this difference, that while with the former nation it was *original*, with the latter it was *derivative*; it is beyond cavil that till the treasures of Greece were disclosed by conquest to the eyes of the ambitious and aspiring Romans, there were no advances made in art among them, worthy distinctive mention—nothing which at all equalled, or can be regarded even as a forerunner to the eminence they subsequently attained.

The Romans in the first ages of their power, under the dominion of the kings, and in the earlier periods of the republic, were practically speaking, unacquainted with the liberal arts. Simple, frugal, and hardy, renowned for wisdom in the senate, and valour in the field, their minds were more engrossed with constant endeavours to preserve unimpaired the political institutions of their country, than to produce ought great or noble in architecture, sculpture, and painting. The severity of their manners forbade all unnecessary display,—they seemed entirely destitute of all love for the beautiful, and all taste to appreciate it: the great men of the time were neglectful of their city, and careless to adorn it. They passed the principal part of their time, says Sallust, in the retirement of the country, practising the frugality which prevailed in the age, attending to the cultivation of their farms, taking no pride in the outward decoration of their capital, and only visiting it upon occasions of religious and judicial solemnity. Everything in short, combines to prove that, unlike their celebrated predecessors, they achieved nothing—unaided and alone, in exalted art. The commencement of their artistic excellence, must be dated from the period when the conquering legions of Scylla, laid siege to the elegant and luxurious Athens; and as the very extreme of refinement to which she had arrived, proved a self-destroying power in her constitution, and, co-operating with other causes, sapped the vitals of her strength, she fell an easy prey to the fury of the relentless dictator; under his revolutionary violence the city of Athens was sacked, pilaged, and destroyed: her matchless monuments of art were rudely transferred from their legitimate resting places—were seized as trophies of Roman valour, and sent to the capital to grace a Roman triumph. Unsparing indeed and merciless was the hand of the conqueror upon the once glorious and sacred city; every thing of value was removed, even to the ornaments which decorated the friezes of the temples, and the basso relievos on the walls. Syracuse, Carthage, and Corinth shared a similar fate; spoliation and pillage marked universally the progress of the Roman arms; and the once proud states of Greece were, one and all, compelled to own the superiority and bow to the power of the foe.

Thenceforward, Rome presented a different aspect from what she had done formerly; no longer severely great, and nationally simple, she had laid aside the just, and equitable spirit of her ancestors, and by embarking in an unprincipled war, became, by her conquest of Greece, possessed of some of the proudest memorials of human genius. Italy was at once inundated with the productions of Greek talent; men stood astonished at the perfection of works—the similitudes to which they had never before witnessed. Grecian artists were everywhere caressed and sought after, and although this, in some respects was desirable, yet, at the same time, it had the effect of putting a complete extinguisher upon whatever rising talent the Roman artists might have possessed. When the grand, the majestic, and the beautiful from Attica was exposed to the eyes of the proud citizens of the imperial city, they were charmed, fascinated, and spell bound; they regarded what they saw, as evidencing consummate excellence, and despairing of equalling that which they deemed unapproachable; the spirit of emulation died within them.[*]

The influx of foreign productions entirely suffocated native Italian genius, Greek productions became matters of property, and dealers sprung up who manufactured originals to supply the market of the rich collector; galleries were formed to produce genius, which had sprung up, from national demand, without a single gallery, or a single collection of any works, except the productions of their native soil. The most celebrated works were copied and re-copied by the Greeks in all parts of the Mediterranean. Horace alludes to this, and there can be no doubt whatever that the effect was to render all native attempts of the Romans and Etruscans no longer available. For not one great artist is named during the whole period of progressive decay, from the Cæsars to Constantine; and the Romans or Latins never produced any talent worth consideration, till the revival of art in Italy, after so many ages, in the 15th century.[†]

It is, therefore, abundantly clear from this comparison, that great abatement on the score of originality must be made when reflecting on the peculiar causes, which contributed to the full development of art in ancient Rome. While among the gifted inhabitants of Greece, its principles and its practice seem thoroughly indigenous; while we search in vain, the arts of preceding and contemporaneous nations for any traces of these manifold excellences which distinguish their immortal productions; while, in short, the eminence they attained, mainly resulted from a creative, an ever active self energising influence possessed by the national intellect; with the people of Rome it was as we have seen, entirely and emphatically otherwise. They of themselves evolved, not the material elements of the expressive and the beautiful; they derived all their notions of them from their prostrate rivals, the Greeks. Their architecture, their sculpture, and their painting, all breathes of Attica. It was constantly the aim of the Italian artists to cultivate the Attic taste, they laboured not to produce a distinctive style of art, but endeavoured simply to travel in the path, previously followed by the people of Greece.

To do them, however, justice, it should be remarked that they appear less fettered in their architectural productions. In this branch of art, we discern characteristics more strictly national, and less slavishly imitative than these which distinguish their sculpture or their painting. For although we are aware that before the conquest of Greece, the structures of Rome were both rude and inelegant, and that to the Greeks, the Romans were especially indebted for the more polished forms of columnar architecture, yet as it has been judiciously observed by Mr. Hosking, "the difference between the Greek and Roman styles of architecture is not merely in the preference given to one, over another peculiar mode of columnar arrangement and composition, but a different taste pervades even the details;" and a wide departure is frequently to be traced from the primitive forms of the ancient models.

By their discovery of the arch, which undoubtedly was unknown to the Greeks, the principles of their architecture became more flexible and less unbending; and they were enabled thereby, we do not say to render their productions more strictly beautiful, but more decorative and profusely ornate. The simplicity of the Greek forms could not be excelled by any additional decorative embellishment, the outline of their purest edifices was in perfect harmony with all the acknowledged principles of exalted art. But still, the Romans, whom unbounded military success had swelled with the workings of the most ambitious pride, anxious to erect edifices of corresponding majesty with their achievements in the field, which should be fit memorials of the victories they had won, and appropriate receptacles of the trophies they had captured, threw around the architecture of their city all the fascinations of gorgeous and elaborate decoration, and that violation of the principles of pure taste observable in their works, which if extended to painting and sculpture, would have appeared ridiculous—was in architecture redeemed, by the vastness of the objects to which it was applied, and the nature of the ends it was intended to serve. In all their buildings they certainly show a less refined taste than the people of Greece: it will be seen that they relied for effect less on the simplicity of form and outline, than on the multiplicity of detail, and glittering profusion of ornament. At the same time let us not deny that splendid were the structures, and magnificent the edifices which, under the sway of the Cæsars, adorned the Imperial city.

---

[*] We intend these remarks to apply chiefly to sculpture and painting, they cannot be extended to architecture, as we shall hereafter see, without considerable modification.

[†] See Art, Painting. Ency. Britannia.

> "Not Babylon,
> Nor great Alcairo, such magnificence
> Equalled in all their glories, to enshrine
> Belus or Serapis, their gods, or seat
> Their kings, when Egypt with Assyria strove
> In wealth and luxury."

But, even with this ready acknowledgment of the distinctive excellence attained by the Romans in this branch of art, a reflection presses immediately upon our minds, which detracts from the glory of the nation itself, and gives us humiliating thoughts of their condition, even while we admire the splendour of their city. With the people of Greece the period of greatest architectural triumph was contemporaneously with their possession of the purest political freedom. The enthusiasm in favour of art was not confined to a few, but pervaded the minds of the whole people; Pericles was but the instrument of the national will—merely acted in conformity with the national spirit; but in Rome there was unquestionably magnificence, yet it was the magnificence not of popular enthusiasm, not as the result of any love for the beautiful pervading the mind of the nation, but rather of a few accomplished, but withal tyrannic emperors. The liberty which had distinguished the nation in the purer ages of the republic, which had been at once the consolidation of their political system, and the secret of their military success, was fast vanishing away. Under the domination first of dictators and then of emperors, the people lost, one after another, the principles of pure and exalted liberty; tyranny usurped the place of freedom, and while there was thrown around their declining dynasty all the splendour which characterizes an Eastern empire, it was at the same time in near connection with that slavish and degrading prostration of the nation's mind, which is its inseparable concomitant.

Architecture then, with all its multiform resources of grandeur and beauty was resorted to, and diligently encouraged by the Roman emperors; not, as was the case with the rulers of Greece, with a view of rousing the minds of the nation at large to an appreciation of the varied forms of material beauty, as contributing thereby to the formation of an elevated and dignified character, but rather from the desire to render the people unconscious of the value of those privileges they were snatching from their grasp. The city was everywhere adorned with emblems of their valour, and trophies of their military success—temples, columns, triumphal arches and fora, were raised in honour of individual emperors, and the mighty deeds for which they were said to be conspicuous, just to cast a false glare around the real condition of the nation, and to blind them to any sense of that thraldom, as degrading, as it should have been felt to be galling, of which they were diligently forging the chains. Instead of the severe manners and stern morality which marked the times of a Brutus and a Scippio, there was introduced that extreme luxury, which comports well with the establishment of an Eastern absolutism, and which invariably weakens, enervates, and eventually destroys the people among whom it takes root.

Under the continual agency of such an influence, even architecture itself gradually declined—all taste was corrupted, and art consequently soon fell into utter extinction. The empire itself fell by an act of suicide, and dragged into the chasm, literature, science and art, and for many ages the slumber of primitive barbarism enwrapped the face of Europe. Unlike, however, other nations who, when once ruined, have been ruined utterly, she "has conquered and been conquered—and again has conquered her conquerors." After her ancient fall, she was destined once more to rise again,—"when her carnal empire had been stripped off from her, she came forth as the queen of a spiritual empire, and within her walls, the dead seem to stand side by side with the living, in awful and most indisguisable communion." Her arts again revived in the 15th century, Italy vindicated to herself the possession of that originality she had not evidenced in ancient time—she came forth like a giant refreshed with sleep, and reared up men of the profoundest genius, such as Michael Angelo, Raffaelle, Leonardi, Titian, and others, who have shed a halo of glory around the age they adorned, and rendered it memorable and illustrious in the annals of art.

Here then it is time to close—we have traced the rise of the arts in the two countries, and have seen that while with the one they were original, with the other they were derivative: we have traced their progressive advancement, and have seen the different characteristics of the two nations, at the period when they were in their highest excellence; we have shown that while in Greece they were conjoined with free political institutions, in Rome they, in far too great a degree were the handmaids and attendants on tyranny. Finally, we have glanced at their downfall, and while we have perceived the dominion of death over Greece to be total, as far as all real greatness is concerned; we have marked the re-vivifying energy exhibited by Rome, and the marvellous display of genius which she has produced in modern times. We have endeavoured in all we have written to do full justice to the claims which the arts of the two countries have, for preference and superiority, and while firm in the opinion that Greece must unquestionably bear the palm, have striven not to forget what was due to Imperial Rome, as the once proud mistress of the world.

108, *Mount Street, Grosvenor Square,*
August 20, 1840.

PUBLIC BUILDINGS IN LONDON.

A Critical Review of the Public Buildings, Statues and Ornaments in and about London and Westminster—1734.

BY RALPH.

(Concluded from page 304.*)*

Gray's Inn is certainly too considerable a place to be passed over unobserved: but the notice we shall take of it, will be rather in compliment to what it might have been made, not what it is at present; it is no more than a confused heap of ugly buildings that have neither order, regularity or connection, and yet the ground they stand on was capable of all: they might have had a fine open front to the street, and another to the gardens, and that too with as little expence: but the taste of our ancestors did not seem to be altogether fixed on beauty, and we ourselves make but very slow advances towards a reformation. As to the gardens belonging to this Inn, they are certainly an advantage to the students there, and a convenience to the town in general; and if they have not many beauties to entertain you, they have few absurdities to disgust you: it is true indeed they might be made much better than they are, by keeping the vistas full of trees, the walks smooth, and the borders even. The mount and summer-house upon the top of it, might be made quite delightful, and if the two porticos at the ends of the terrace, had been in taste, they would have given an air of magnificence, which at present is much wanting. I could wish too that the piece of ground between the two terraces and the road, was made better use of by the society, than turning it into a kitchen garden, as well as that next Gray's-inn-lane: these two spots might have been covered with trees, in the most beautiful manner, and supplied with fountains, which would make this place one of the most delightful spots about town.

It will be impossible to pass by the new church of St. George, Bloomsbury, without giving it a very particular survey; it is built all of stone, is adorned with a pompous portico, can boast many other decorations, has been stinted in no expense, and yet, upon the whole, is ridiculous and absurd, even to a proverb. The reason is this; the builder mistook whim for genius, and ornament for taste: he has even erred so much, that the very portico does not seem to be in the middle of the church, and as to the steeple, it is stuck on like a wen to the rest of the building; then the execrable conceit of setting up the king on the top of it, excites nothing but laughter in the ignorant, and contempt in the judge. In short, it is a lasting reflexion on the fame of the architect, and the understanding of those who employed him.

The new church of St. Giles's is one of the most simple and elegant of the modern structures; it is raised at very little expence, has very few ornaments, and little beside the propriety of its parts, and the harmony of the whole, to excite attention and challenge applause; yet still it pleases, and justly too; the east end is both plain and majestic, and there is nothing in the west to object to but the smallness of the doors, and the poverty of appearance that must necessarily follow. The steeple is light, airy, and genteel, argues a good deal of genius in the architect, and looks very well both in comparison with the body of the church, and when it is considered as a building by itself, in a distant prospect. Yet, after all I have confessed in favour of this edifice, I cannot help again arraigning the superstition of situating churches due east and west; for, in complaisance to this folly, the building before us has lost a great advantage it might have otherwise enjoyed; I mean the making the east end the front, and placing it in such a manner as to have ended the vista of what is called Broad St. Giles's; whereas, now, it is nowhere to be seen with ease to the eye, or so as justly to comprehend the symmetry and connexion of the whole.

There is nothing in the whole prodigious length of the two Bond Streets, or in any of the adjacent places, though almost all erected within our memories, that has any thing worth our attention; several little, wretched attempts there are at foppery in building, but they are even too inconsiderable for censure.

There is something particular in the manner of George Street, which deserves our attention, it being laid out so considerably wider at the upper end, towards Hanover Square, that it quite reverses the perspective, and shows the end of the vista broader than the beginning, which was calculated to give a nobler view of the square itself at the entrance, and a better prospect down the street from the other side; both ways the effect answers the intention, and we have only to lament that the buildings themselves are not more worthy this pains to show them to advantage. The west side of Hanover Square is uniform, argues a very tolerable taste in the architect, and deserves a good deal of approbation; but all the rest are intolerable, and deserve no attention at all.

I must own this, however, that the view down George Street, from the upper side of the square, is one of the most entertaining in the whole city: the sides of the square, the area in the middle, the breaks of building that form the entrance of the vista, the vista itself, but, above all, the beautiful projection of the portico of St. George's Church, are all circumstances that unite in beauty, and make the scene perfect.

If any thing is wanting, it is a graced building at the end of the vista; and the chapel which now stands there afforded a handsome opportunity even for adding this too, if the undertakers had taste or generosity enough to make the best use of it.

The church of St. George's is, at least, one of the most elegant in London; the portico is stately and august, the steeple handsome and well proportioned, and the north and east prospects very well worth a sincere approbation: but even this structure is nowhere to be seen but in profile, as mentioned above, though situated in the very centre of the vista that leads to Grosvenor Square, and were it not for two or three intervening houses, would be seen in the noblest point of light in the world. In short, it would fill the eye quite from the other side of that square in all its perfection; and I leave any one to judge to what superior advantage it would then appear, and how many more beauties it would add to the prospect.

We must now cross the road to Oxford, or Cavendish Square, I am uncertain by which of those names it is most properly distinguished, and there we shall see the folly of attempting great things, before we are sure we can accomplish little ones. Here it is, the modern plague of building was first stayed, and I think the rude unfinished figure of this project should deter others from a like infatuation. When we see any thing like grandeur or beauty going forward, we are uneasy till it is finished, but when we see it interrupted, or entirely laid aside, we are not only angry with the disappointment, but the author too; I am morally assured that more people are displeased at seeing this square lie in its present neglected condition, than are entertained with what was meant for elegance or ornament in it. To be free, nobody should undertake things of this public nature, without resolving to go through with them; for the declining it afterwards is so notorious, that the whole world has occasion to blame it, though few or none can be sufficiently acquainted with the motives, so as either to defend or absolve.

It is said the imperfect side of this square was laid out for a certain nobleman's palace, which was to have extended the whole length; and that the two detached houses which now stand at each end of the line, were to have been the wings; I am apt to believe this can be no other than a vulgar mistake, for these structures, though exactly alike, could have been no way of a piece with any regular or stately building; and it is to be presumed this nobleman would have as little attempted any other, as he would have left any attempt unfinished.

The house of the late Lord Bingley, on the west side of the square, is one of the most singular pieces of architecture about town; in my opinion it is rather like a convent than the residence of a man of quality, and seems more a copy of some of Poussin's landscape ornaments, than a design to imitate any of the genuine beauties of building. I may be mistaken, perhaps, in my opinion, and what I esteem Gothic, heavy and fantastic, may really be harmonious, light and elegant; so I leave the determination of it to better judges.

I have now brought this painful survey almost to an end, and am not a little pleased on that account; it was not so easy a task as I at first imagined, and whoever will make it their guide to measure the same ground, will be of the same opinion; huge, indeed, as this city is, the toil of examining it from place to place is the least; for a building ought to be viewed several times before we come to a conclusion, either with regard to its faults or beauties: part of that trouble this Review was designed to save, and if it will not polish the taste, or reform the judgment, it will serve, however, as an index to the public buildings, &c., and point out to the stranger whatever is worthy of his attention.

Grosvenor Square is not only the last addition which has been made to the town, but the last in situation too; and as it is generally understood to be the finest of all our squares, I am sorry I have the opportunity to say it has so few advantages to recommend it, and that the public is disposed to like these few so well; I have frequently observed already, that magnificence should never be attempted; it ought always to be perfect and complete, or else the very essay mocks the builder, and excites ridicule instead of admiration. This is the case of Grosvenor Square; it was meant to be very fine, but has miscarried very unfortunately in the execution; there is no harmony or agreement in the parts which compose it, neither is there one of those parts which can make us any thing like amends for the irregularity of the whole. The triple house, of the north side, is a wretched attempt at something extraordinary; but I hope not many people, beside the purchasers, are deceived in their opinions of its merits; for it is not only bad in itself, but in its situation too; had it been in the centre of the line, there would have been some excuse for the project, but as it is almost in one extreme, there can be no plea remaining; unless the view of taking in some young heir to buy it, at a great rate, may be allowed one.

The east side is the only regular one of the four, and is undoubtedly much the most elegant for that reason; but then even this is not in taste, and neither the house in the middle, nor the two which serve as wings, have anything remarkable to recommend them, though the builder seems to design they should; the pediment over that in the middle, particularly, is proportioned only to the breadth of that house, and not the entire line; whereby it appears that the artist forgot his first design, of making this the main body to the whole.

The other two sides are little better than a collection of whims and frolics in building, without anything like order or beauty, and therefore deserving no farther consideration.

I have often wondered that, in the number of squares which adorn this city, no builder ever thought of an octangular one; I am fully persuaded that it would make a nobler figure than any we have seen yet, and is capable of greater beauties; it is to be observed, though, that I would not have it broken at the angles, for the sake of the streets or entrances, because that would spoil the theatrical appearance of the whole; I would rather choose to have all those inlets under an arch, in the centre of each particular side, and if the superstructure was elevated proportionably, in a grand and noble stile, what was principally meant as a conveniency, would prove one of the most magnificent ornaments in the world.

I would not be understood here as recommending any farther additions to this mighty metropolis; no, I am of opinion the head is already much too big for the body, and therefore its farther growth cannot be checked too soon. But this I leave to the determination of wiser heads than mine.

STONE FOR THE NEW HOUSES OF PARLIAMENT.

Sir—It is much to be wished that anonymous writers would endeavour to give more practical proof of their candour, love of fair play, and other good qualities and dispositions which their signatures profess. In the letter in your last number on the "Stone for the new Houses of Parliament," by "A Lover of Fair Play," though there are some just and reasonable complaints, there is still so much that is unjust and ungenerous, that I think few who have taken an impartial view of the subject will think he has any claim to the honourable title he has assumed.

I am far from thinking that Mr. Barry and the Commissioners are altogether free from censure, and I am decidedly of opinion, that after deviating from their first recommendation, they should be called upon to lay before the public a second report explanatory of the changes which have taken place; and till this is done, I think every body has a right to give his own opinion on the subject. At the same time, however, I think that the tone in which the subject has been treated in many public prints, and which is echoed by your correspondent, cannot be too strongly deprecated. When men of science and reputation are engaged on a public object, their conduct is certainly open to public discussion, but such discussions should be conducted in the spirit of cool and impartial inquiry; the correctness of the judgment of the parties in question should be carefully investigated, but the correctness of their intentions should not for a moment be called in question. Had this been the course pursued on the present subject, there can be no doubt that a satisfactory explanation would have been given by the Commissioners; but when every kind of abuse and brutal insult has been heaped upon them by the lowest political prints, I think no one need wonder that men of science and integrity would not stoop to defend themselves from such impotent attacks.

The following appear to me to be (*primâ facie*) the complaints which may be reasonably brought against the commissioners:—

1. That having been commissioned to make a survey of the quarries throughout the United Kingdom, they omitted to examine those of Ireland.

2. That a very superior Irish stone having been offered to them, without charge for royalty, they declined the offer.

3. That they recommended (among other reasons), "for facility and economy of conversion," a stone which could not be procured either in sufficient quantity, or in blocks of a sufficient size.

4. That on the failure of this quarry, they did not go to another which might be considered to stand next in their report, but to a new quarry, which has also proved insufficient to supply the required quantity.

5. That this deficiency of supply has not been made good by application to the quarry at first so strongly recommended, which is said to contain stone exactly similar to that of the new quarry, and which might be expected to be at the least capable of supplying *some* stone; but that two other quarries have been applied to which are not mentioned in the Commissioners' report. In short, that after all the parade of the commission, the supply of stone has been obtained from three several quarries, not one of which was recommended, nor even its existence hinted at, in the report of the Commissioners.

This seems a strong case against them, and certainly evinces a want of care in the first survey, and some inconsistency in their subsequent conduct, but I have no doubt that many of the objections are capable of satisfactory explanation.

The first charge, I think, a very dubious one, and rests upon the simple question of whether they were commissioned to visit the Irish quarries or not.

The second is entirely refuted by the very judicious remarks with which you have favoured your readers, and by the fact that in colour and general appearance the stone in question was altogether unsuitable to the purpose.

The third certainly evinces some want of care. As to the beauty and probable durability of the Bolsover stone, there can be no doubt, but the thinness of the majority of the beds, which is the great objection, is obvious on a slight examination of the quarry; though the Commissioners, in their just admiration of the quality, might have flattered themselves that by sinking deeper or opening new quarries in the neighbourhood, better blocks could be obtained. It should also be borne in mind that they do not distinctly specify the quarry, but recommend the stone of Bolsover Moor *and its neighbourhood*.

The fourth objection at first sight appears reasonable, but on consideration I think no one will deny that the stone first recommended having proved insufficient in quantity, Mr. Barry was quite right in adopting that which most resembled it in quality, though he had not seen it when acting on the commission; being also within a few miles of Bolsover, it may (though by a little stretch of the meaning of the words) be considered to be in "its neighbourhood."

The fifth objection I am unable satisfactorily to answer. I do not see why the Bolsover stone should not have been used, so far as it would go, in supplying the deficiency (which I believe to be only temporary) in the supply of the other quarry. The quality of the Bolsover appears to me to be far superior to the Anston and infinitely better than the Steetley (which latter, however, I think is only used internally), and there certainly is stone at Bolsover of sufficient size, though not in large quantities. The circumstance of the Woodhouse quarry being only lately discovered (or rather *re*-discovered), removes the objection of its not being in the report; but the Steetley and Anston being old and well-known quarries, it certainly looks like negligence not to have reported on them, and like inconsistency to have selected them though not mentioned in the report. One would certainly have expected that before going to these quarries, consistency would have prompted strong measures, such as sinking shafts, opening new quarries, &c., for ascertaining whether suitable stone was not to be obtained on Bolsover Moor. Such measures may have been taken—I only mention this as one of the points which require clearing up for the sake of satisfying the public.

The most important question, however, after all, is, whether the stone now using is of suitable quality. On this question I am not capable of giving an opinion, but will state a few points which have struck me on an examination of the different varieties of stone, with a view to call forth the remarks of more competent judges.

1. The stone from Mansfield-wood House is not, as has been stated, *exactly* like the Bolsover. It very strongly resembles it, but differs in having a browner and less brilliant colour, and in having a far greater proportion of black metallic specks, which in some blocks are minute and clearly defined, in others large and diffused. This difference appears to be a great cause of the difference of colour which is observed among the blocks. On the whole, I think the Mansfield-wood House a darker coloured and less beautiful stone than the Bolsover, but still a very beautiful stone.

2. The question may be asked, what proof have we of the durability of this stone? In answer to this, I think it may be safely said, that there is every reason to believe that the stone used in the Norman parts of Southwell Minster, and which was supposed to be the Bolsover stone, was, in fact, procured from Mansfield-wood House. A comparison of the stone from the two quarries with that at Southwell would, I think, satisfy any careful observer on this head.

3. The Anston stone does not appear equal to either the Mansfield-wood House or the Bolsover, but is still a good and probably a very durable stone.

4. The Steetley appears to be a very friable stone, certainly semi-crystalline, but the crystals detached and ill-cemented. It is, I believe, only used internally, but I much wonder that the infinitely more beautiful stone of Roche Abbey, which is so eminently suited to internal work, was not preferred.

What your correspondent can have discovered in Mr. Bald's very interesting papers, to confirm so decidedly the superiority of the Irish limestones, I am at a loss to discover. Mr. Bald's papers only treat of the white limestone of Antrim, which no one even dreamed of recommending for the Houses of Parliament, and which Mr. Bald says should never be used for any buildings where durability is an object. Your correspondent is, perhaps, not aware that Dr. Smith, of whom Mr. Bald speaks with veneration as the father of English geology, and who, he says, has carefully examined the Antrim limestone, is himself one of the Commissioners who have been so much vilified.

I have the honour to be, Sir,
London, Your most obedient servant,
September 3rd, 1840. Another Lover of Fair Play.

P.S.—It is a question worthy of being investigated, whether magnesian limestones have not a tendency to acquire a dark and gloomy colour by age. The old churches and other buildings on that formation have certainly a gloomy appearance compared with those in some parts of Northamptonshire and Lincolnshire, which are of oolite. May it not be the case that the lichens which grow on the magnesian limestone are of a dark disagreeable colour, while those which thrive on the oolites are of a white livelier hue? This is rather an important question.

ON FIRING BLASTS UNDER WATER.

Mr. Editor,—It occurs to me that a much more simple, and much more efficient method for firing blasts under water, may be obtained, than the method used to break up the Royal George, and a method so simple that it would not require a colonel to superintend. A percussion cap is all that is necessary to fire 10,000 lb. of powder as easily as an ounce. Suppose that an air-tight compartment at the top of the powder cylinder, to be fitted up with an apparatus similar to the lock of a gun, and a strong spring carrying 4 or 5 hammers, to strike as many caps. The cock to set the spring being ground into the side of the box, and fitted with a leather collar; the trigger should also pass into the box in a similar manner. What would be more easily for the diver after having secured the cylinder strongly to its place, than to raise the spring and fasten a strong line to the trigger; the line might be of any length, and when strongly pulled would as effectually fire the blast as a dozen batteries. The caps being inside the air-tight box would be protected from the water and kept dry.

Mines might thus be fired at the exact instant when they would do the greatest mischief to the enemy.

It is a fact well known to engineers and miners, that when it is desirous to detach a large mass of rock by means of several blasts, a great part of the effect is lost by not being able to explode them at the same instant; but by means of percussion caps a hundred blasts might be fired at the same instant, a very simple arrangement would be sufficient for this purpose.

Would not cannon be also very easily fired by large percussion caps, and struck by a small hammer held in the hand of the person appointed to discharge the gun?

Those lucifer matches which explode by friction I have used without failure to fire trains of gunpowder, by merely placing two or three in the slit end of a stick (kept down by a large stone), which on being bent sideways and detained in that position by another stick, to which a long line is fastened, on pulling the line the latter stick is withdrawn, and the first carrying the matches, springs straight, the matches scrubbing on the ground or dry stone, explode, and fire the train.

Should you think these desultory remarks worth a place in your Journal, you will oblige,

Your's, respectfully,
C. L. Dresser.

Commercial Buildings, Leeds, Sept. 4, 1840.

FELLING TIMBER.

Sir—Should the enclosed be of sufficient value in your estimation, to entitle it to a place in the Journal, it is at your service. I cut it out of the "New York Albion" a few years ago, while residing in America. The subject of felling timber is of more consequence to engineers and architects than many of them have supposed, as few would feel desirous of knowing that their labours are not destined in many instances to endure longer than the brief period of their own life, should the dry-rot allow it even that extent of duration.

I was told by a very skilful mechanic in the city of Philadelphia, that he had observed in his own experience that timber cut in the winter was invariably more thoroughly impregnated with sap than at any other time. That as soon as the new wood was at its full growth, say in August, he had found was the best time for felling the timber.

I have myself seen thousands of trees lying in the woods of America, in the state denominated "logged," (that is cut into lengths for the mills) which, were rapidly hastening to decay, and in almost all these cases it was owing to their having been cut in the winter, as there all the logs are left after being cut, till they are needed for the mill, and many are so left for months, nor is it uncommon to see timber under the saw, of which at least one-third is at the time in a state of absolute decay.

Your's, very respectfully,

J. HOLDEN.

36, *All Saints Place, Ormond Street, Manchester,*
August 22, 1840.

"Mr. Rainey, of Middletown, Conn., a ship-builder of considerable experience, having become convinced that the sap was the cause of the decay of wood, instituted a series of experiments to ascertain its place in different seasons of the year, and found that in the winter, the heart wood contained much more than the sap wood, while in the summer it seemed concentrated in the alburnum or outside layers of wood. It has been generally supposed that the sap of the tree was principally in the roots during the winter, and acting on this supposition, Mr. Rainey had preferred for ship building, timber cut in the winter; some cases, however, in which timber cut in the summer was used with that cut in the winter, and remained sound while the latter decayed, induced an investigation as to the cause, and resulted as stated. Mr. R. now uses timber cut as far from December as possible, and finds much less cause for complaint than formerly. The following was one of the experiments that led Mr. R. to doubt the propriety of cutting timber in winter:—

" 'Having cut a small oak staddle, on or about the 20th of June, I placed several pieces of it in the fire place, and put a fire under them; after a little while there appeared at the end of the sticks a wet circle describing the exact thickness of the alburnum, or sap wood, and when they became considerably heated, the steam rushed with violence from the tubes of the sap wood, while there was but a small appearance of vapour from the heart wood. About the same day of December, of the same year, I had another small oak cut, and went through with the same process of heating several pieces of the wood; and when they began to be heated, the whole surface of the heart wood, except a small circle enclosing the pith, was wet, but the alburnum was dry, and when they were fairly heated through, the steam rushed with violence from the heart wood, though the whole quantity that escaped, was not so large as in the former case. The results of these experiments accord with a well known fact in regard to the sugar maple, namely, that no sap can be obtained from the tubes of the alburnum of the tree, and therefore they are obliged to bore a hole for the tube through the alburnum, into the heart wood before it will run.'

"Mr. Rainey's inference as to the position of the sap during the severe weather of winter, is probably correct, as we have observed many appearances that would go to confirm it; but, that at the time of making sugar, the sap is found in the heart wood of the maple, is decidedly incorrect, as every person acquainted with the manufacture well knows. In many cases in tapping the trees, the heart wood is not touched at all, and it is deemed desirable to avoid it when practicable.—The sap of the maple will not, however, flow until the temperature of the earth and air has been raised by the sun of spring, and the circulation, which is partially or totally suspended in the alburnum during the severe frosts, is restored.—The relative position of the sap is consequently changed from what it was a few weeks previous, having passed from the centre to the surface through the lateral pores, or what is called the silver grain, as well as commenced its flow upwards to the expanding leaves and branches.

"Farmers find the cutting of timber for posts and rails an important item in their profit or loss account; and if Mr. Rainey's experiments as to the duration of timber can be fully relied upon, or substantiated by further experience, a very great point in domestic farming economy would be gained. We think the early settlers of Western New York could throw much light on this subject, by ascertaining the relative duration of their rail fences made from timber cut in the winter, or midsummer, as most farms must have had specimens of both kinds; and any notices of this nature, furnished us, shall be inserted with pleasure."

TIDE GAUGE.

SIR—My attention was directed by a friend, who is a Civil Engineer, to a paragraph in "The Civil Engineer and Architect's Journal," for May 1838, under the head of "Proceedings of Scientific Societies," Royal Society, giving a description of a new Tide Gauge, constructed by T. G. Bunt, and erected on the eastern bank of the river Avon, in front of the Hotwell House, Bristol, in 1837. At this I was astonished, as I was on a visit at Mr. Mitchell's, at Sheerness Dock-yard, three or four years since, when Mr. T. G. Bunt was carrying on a *self-established* correspondence with Mr. Mitchell, *who was a stranger to him*, and Mr. Mitchell, to my knowledge, actually sent him a drawing of his tide gauge with a description, which so *singularly* and *so nicely agrees* with that given by Mr. Bunt of his *new tide gauge;* and Mr. M. showed me at the time, some of the letters that he had received from Mr. Bunt, which had they come to me from a stranger as they did Mr. Mitchell, I should have thought it great impudence. I have since shown this paragraph to Mr. Mitchell, who, like the immortal Watt, with "dirty" Prony, was too inoffensive a man to attack the person when the injustice done was mentioned to him. I have since this again asked Mr. Mitchell if he had known Mr. Bunt before? He replied, no; nor have I ever seen him. I asked Mr. M. why he ever answered the first letter? He said (and should this meet his Mr. M.'s eye, I hope he will forgive me publishing private conversation), "why, really I thought the person Mr. Bunt, might have a family like myself, and might be striving to gain something by working out his own ideas, at seeing mine in its complete state, but I had no idea of such as you have shown me."

Mr. M. then again showed me his "tide gauge," which as aforesaid, was erected in all her Majesty's Dock-yards, and has answered admirably for years; he also showed me that of Mr. Lloyds, which is quite different.

A description of Mr. Mitchell's tide gauge may be seen in the "Nautical Magazine," for one of the months In the year, I think, of 1835, and which was inserted by a friend of Mr. M.'s, at *that friend's very kind request.*

Now these facts, for the good of the community at large, especially the various scientific gentlemen that read your Journal, whose protection is of importance, I lay at your disposal, and as it is the duty of every person to crush "plagiarism," I have forwarded this, which I would thank you to give insertion in your valuable scientific and interesting Journal, as a "beacon" to warn persons from being unexpectedly similar passive objects.

I am, Sir, your obedient servant,

JAMES INGLIS.

London, Sept. 2, 1840.

P.S.—Since writing the foregoing, I have seen Mr. Mitchell's son who made the drawings and wrote the description that was sent to Mr. Bunt of Mr. Mitchell's tide gauge, who says that the correspondence could doubtless be produced.

[We have omitted the first part of Mr. Inglis's communication, as it only relates to the invention of a tide gauge which has failed, there is no charge of plagiarism against the party.—EDITOR.]

YSTALYFERA ANTHRACITE IRON.

Mr. Evans, of Manchester, has given a report upon the *strength* of the Ystalyfera Anthracite Pig Iron, of the several qualities, Nos. 1, 2, and 3, with a view to ascertain its properties, particularly in relation to other irons, being the result of about 280 experiments upon rectangular transverse bars. The experiments were made by breaking the bars between supports of their distances; namely, of 4 ft. 6 in. and 2 ft. 3 in. apart.

The trials were confined to the transverse strength of 1-inch rectangular bars, with their several values, as under:—

1st. Specificgravity.—2nd. Modulus of elasticity.—3rd. Transverse strength of 1-inch rectangular bars, 4 ft. 6 in. apart.—4th. Transverse strength of 1-inch rectangular bars, 2 ft. 3 in. apart.*—5th. Ultimate deflections.—6th. Power to resist impact, of which the tables† are divided into, and contain bars broken from

72 specimens of No. 1,
65 ditto of No. 2.
61 ditto of No. 3,

all cast horizontally in stand, melted by coke from the cupola in the usual way;—

44 specimens of bars melted as above, of equal mixtures of Nos. 1, 2, & 3;—

24 specimens ditto, of the same melting and mixture, but afterwards planed down to a perfect 1-inch square gauge; and—

16 specimens ditto, of the same mixture, but melted in the crucible.

The area of breaking section is calculated as the square of the depth, into the breadth, and inversely as the length; an example of which is subjoined, for the bars requiring reduction to 1·00 inch square from excess of area at the fracture or otherwise: thus, No. 12 measured, depth 1·002, breadth 1·005, which, reduced, stands 499·5 lb. in the table, under the head of 4 ft. 6 in. bars.

RULE.—To find from the above table the breaking weight in rectangular bars, calling b and d the breadth and depth in inches, and l the distance between the supports in feet, and putting 4·5 for 4 ft. 6 in., we have $\frac{4\cdot5 + b\,d^2\,S}{l}$ = breaking weights in lbs.—The value of S being taken from the above tables.

For example: What weight would be necessary to break the bar, No. 21, in No. 1 table, 2 inches broad, 3 inches deep, and 6 feet between the supports? According to the rule given above, we have $b = 2$ inches, $d = 3$ inches, $l = 6$ feet, $S = 484$ from the table. Then $\frac{4\cdot5 \times b\,d^2\,S}{l} = \frac{4\cdot5 \times 2 \times 3^2 \times 484}{6} =$ 6534 lb.‡

---

[*] The 2 ft. 3 in. bars are reduced to 4 ft. 6 in., as being a fair method of obtaining a more correct mean; a separate column in the tabulated form being set apart for them.

[†] The report contains six tables of experiments made by Mr. Evans, we have given the table only containing the *mean* result of all the experiments.—[Ed.]

[‡] The modulus of elasticity is taken from the deflection caused by 112 lb. on the 4 ft. 6 in. bars.

Elasticity calculated from the deflection caused by 112 lb. on inch square

We will briefly take the mean values of each table, together with a summary of comparison of the whole, &c. §*The specific gravity* of No. 1 Iron at 7·093, is rather under the standard 7·207, as given by Tredgold, but above the mean of the No. 1 in Messrs. Fairbairn and Hodgkinson's list, which give 7·032 for twelve different irons of this number. As Tredgold's is a *general* one, and not the result of any particular number; and as it will be found in Anthracite Iron, as well as in Messrs. F. and H.'s results, that the No. 1 is usually a lighter iron than either of the Nos., the above may be considered a near approximation to the usual irons of the same No. or quality made from coke.

Its modulus of elasticity, the mean of which is 13970644 shows the comparative stiffness of the metal, and is given in pounds per square inch.

The *breaking weights* are given in three separate tables, the mean of which makes 444 lb., 445 lb., and 444·5 lb. respectively, which approximate in rather a singular manner to each other, and must be taken as the best proof of *uniformity of strength* and texture of this number, the value of which, as compared with other irons, stand as under:—

Mean of 72 results upon the Ystalyfera Anthracite Iron, No. 1 444 lb.
Mean ditto of 10 different sorts of No. 1, in Messrs. Fairbairn and Hodgkinson's list . . . . . . 430 lb.

being a superior strength in favour of the Anthracite Iron of about 3½ per cent. I regret that most of the other authorities give the breaking of 1-inch bars on a very limited scale, in few instances distinguishing the different *Nos.* they were made from, and broken between distances of every variety, which is an additional objection to my offering them in the above comparison; but in a summary of a few that I found more easy to reduce, they form rather an inferior value to Messrs. Fairbairn and Hodgkinson's irons.

The following table comprises a summary of the whole of the experiments made by Mr. Evans, together with the same from Messrs. Fairbairn and Hodgkinson's list:—

Summary and Comparison of the Total Mean Results from each of the Tables, together with the same from Messrs. Fairbairn and Hodgkinson's List.

Number of experiments 4 ft. 6 in. between supports, and 2 ft. 3 in. bars, reduced to 4 ft. 6 in.	Specific gravity.	Modulus of elasticity in lb. per square inch, or stiffness.	Breaking weight in lbs. of bars, 4 ft. 6 in. between supports.	Breaking weight in lbs. of bars, 2 ft. 3 in. reduced to 4 ft. 6 in.	Mean breaking weight in lbs. (S.)	Ultimate deflection of 4 ft. 6 in. bars, in parts of an inch.	Power of the 4 ft. 6 in. bars to resist impact.
Mean of 72 on No. 1	7·093	13970644	444	445	444·5	1·843	821
Ditto of 65 on No. 2	7·120	14544293	494	499	496	1·632	811
Ditto of 61 on No. 3	7·130	16622197	531	537	533	1·640	916
Ditto of 41 on equal mixtures of Nos. 1, 2, & 3	7·110	15200982	465	479	471	1·553	749·7
Ditto of the same from the crucible, No. 16	7·190	14894800	551	597	574	1·625	901·2
Ditto of 24 of equal mixtures as the 41, but planed	7·110	14676771	533	539	536	2·447	1313·1
Forty-seven Specimens from Messrs. Fairbairn and Hodgkinson's Tables of Nos. 1, 2, and 3, as under:—							
No. 1. 10	7·032	14132994	433	428	430	1·597	694
No. 2. 25	7·029	14570118	435	443	439	1·626	711
No. 3. 12	7·122	17683712	478	487	483	1·374	685
Summary of the Mean of the 198 Results of the 3 Qualities of Anthracite, and the 47 from Messrs. Fairbairn and Hodgkinson's List.							
198	7·114	15045711	489	493	491	1·705	849
47	7·060	15462274	448	542	450	1·532	696

In making a comparison of the same numbers of the Anthracite Iron, and those which are comprised in the latter 47 results, the three first of the six only, contained in the preceding table, must be taken, the other specimens being on iron, under other conditions, containing the mixed, planed, and crucible results, &c., a final mean of which may be taken as above:—

Which taken singly, or collectively, show a superior value in every column in favour of Anthracite Iron as compared with the most numerous list of other makes; and it would appear that the No. 1 is the most uniform in texture, strength, &c., having the greatest fluidity, softest, and lowest specific gravity, and for its strength, which is the weakest, is most to be relied upon, as far as it extends.

The No. 2, less uniform a little in texture, and strength, fluidity, &c., but of higher specific gravity, and stronger than No. 1.

The No. 3 still less to be depended upon in the above qualities, but of increased specific gravity and strength to the No. 2.

The equal mixtures show a deterioration of the several Nos., compared to their values separately, and the same as regards specific gravity. The same, but cast from a crucible, exhibit an improved list of values, including a greater specific gravity.

The planed bars show an increased strength above the same metal in the black bar: this is the only specimen whose strength is increased, without the specific gravity being greater also, which must be due to the planing, and not any alteration of metal, &c.

It may be inferred from the whole of the tables, except the last, and the higher specific gravity exhibited by the Iron, the greater the strength.

---

bars.—l = distance in inches between supports.—w = 112 lb.—c = breadth of bar.—d = depth of bar.—a = defluction caused by 112 lb.

Formula. $\frac{w\,l^3}{4\,c\,d^3\,a} = m$, or modulus of elasticity in lb. to work which logarithms had better be employed.

For the above formula, see Messrs. Fairbairn and Hodgkinson's report, Tredgold, &c.

§ "The precise determination of the maximum and minimum specific gravity of cast-iron is of importance to the Founder and Engineer as giving the data upon which the weight of castings are estimated, and which, as stated by authors, are an unsafe guide, inasmuch as the specific gravity of cast-iron varies with its composition,—the way in which it is cast, the rate of its cooling, and the depth of the mould, to an extent not generally considered; hence the different specific gravities of bars cast *vertical*, and those cast *horizontally*."—*Mallet on Iron*. See 7th Report of British Association.

IMPROVEMENT OF LOUGH ERNE, IRELAND.

Report of the improvement of Lough Erne, for the purpose of rendering Navigable for Steam Vessels, and other Craft, and for keeping the Lake at a more uniform level.

The Upper Lake extends from Belturbet to Enniskillen, and can be navigated through the channels or sources; that along the eastern side is 18 miles in length, and that on the western is about 16 miles, which are described by red dotted lines on the map or chart No. 1.

The Lower Lake extends from Enniskillen to Belleek, its north western extremity, and measures about 24 miles.

The fall from the Upper Lake at Lisgoole Abbey to the Lake at Portora is only 2¼ inches. This is occasioned by the Danes Eel Weirs, the bridges at Enniskillen, and the shoal at Portora.

The Upper and Lower Lakes, considered together, present a most magnificent sheet of water, interspersed with numerous islands, which are in general highly cultivated; and for beauty and luxuriance of scenery cannot well be surpassed, and forms one of the finest lines of inland steam boat communication in the United Kingdom, creating as it does one direct line from east to west of upwards of 42 miles in extent, besides the numerous inlets to every village and farm along its coasts, which may be safely calculated at three times the above length—the whole of which may, when improved, be navigated without the interruption of a single lock or other obstruction, so that, with good steamers, the journey from Belleek to Enniskillen, Belturbet and Wattle Bridge, may be accomplished in a few hours, which at present, I am told, takes the boats, containing only a few tons of goods, upwards of a week, besides their having to be lightened at every shoal to enable them to pass.

The Upper Lough may be termed a series or chain of lakes, branching and ramifying its course along the vallies of the country, forming numerous inlets, which are sufficiently deep at the lowest water to navigate vessels of considerable burthen, and which afford a ready means of transit for merchandize, and the produce of the country, in every direction, particularly to Belturbet, Enniskillen, and Belleek, which latter place is situated on the Lower Lake, and is only three miles distant from the seaport town of Ballyshannon.

Near Wattle Bridge, on the eastern side of the Lough, the Ulster Canal enters, which I expect will be opened in the course of a few months. This canal will form one of the grand outlets for the produce of this finely cultivated country to Belfast, Newry, &c., it being at present shut out completely from competition in these markets, on account of the want of a ready and cheap conveyance by water; and when such great facilities for intercourse and trade present themselves, and requiring comparatively so small a sum for accomplishing such a desirable object, it appears somewhat extraordinary that the improvement of the navigation of this fine sheet of water should have been so long deferred.

The several shoals, eel weirs, and other impediments to the navigation, besides causing the before-mentioned disadvantages, also act as dams across the channel, and retard the natural and regular flow of the water, which is backed up to an incalculable extent, and thrown over the low lands along the different vallies bordering on the lakes, submerging and inundating for several months of the year, from 20,000 to 30,000 acres of the finest land in the country, which, if the water could be taken off, might be brought under the most perfect state of cultivation.

I found, from observations and levels taken on the spot, that the difference of level between the winter floods in January last, and the summer water in May, at the undermentioned points, was as follows, viz.

Belturbet and Wattle Bridge	9 ft.	0 inches.
Enniskillen	7	10
Belleek	4	0

and the surface of the water, between these points, forms nearly an inclined plane. The least or smallest rise is at Belleek, which is owing to the Lower Lake being of so much greater extent than the Upper one, and acting as a compensation reservoir, and allowing the water to escape more uniformly.

Having given a general description of the lake, I will now enter more into detail, and describe the impediments which exist in the narrow parts of the river, their effects, and what alterations are necessary to improve the navigation and drainage of the country from Belleek to Belturbet, and having been supplied, as I before mentioned, with the very accurate charts published by order of the Admiralty, which point out distinctly the deep and shallow parts of the lake; it became, therefore, unnecessary for me to take the soundings of the whole extent of the lakes, my principal duty was to investigate the shoals and impediments existing at the following places and points, viz.

1st. From Belleek to Roscor.
2nd. Portora.
3rd. The two channels and bridges at Enniskillen.
4th. Dane's Eel Weirs.
5th. Carry Bridge.
6th. Black Rock, and some small ridges of gravel, on the south west passage near Crom Castle.
7th. Blockson Shoal, which is within two miles of Belturbet, and composed of solid limestone rock.

Accurate soundings were taken at the above places, and plans, longitudinal and transverse sections have been prepared which I now forward, showing the depth of water, with the line of proposed deepening for improving the navigation and drainage.

The soundings and other observations were taken at a very favourable time, viz., the latter end of last April and the beginning of May, when the season was remarkably fine and dry; so much so that the water was within six inches of the lowest point ever remembered by the oldest inhabitant residing on the Lake—the floods during the previous winter season being the highest ever recollected.

The above being the case, I was afforded a good opportunity of judging of the effects likely to be produced by "reducing the waters to a uniform level."

The datum or surface of water shown on the sections, is supposed to be nine feet eight inches under the lower edge of the string-course at the springing of the abutment arch, S. W. angle of the West bridge at Enniskillen.

At this level, the water being very tranquil, and with scarcely any perceptible current, I found, by taking accurate levels of the shoals at Portora. Enniskillen, and Dane's Eel Weirs, that the difference of surface between the Upper and Lower Lakes, at their extreme points, only amounted to 2¼ ins.—I was gratified upon determining this fact to find there was no necessity for erecting a lock, as I had been led to suppose there was a fall of from two feet to three feet between the two lakes. This not being the case, it will simplify the works required to be done, both in the execution and the expenditure.

The bridge of Belleek is of old construction, and appears in a very dilapidated state. It is built with rubble masonry, and composed of four arches of the following dimensions, viz.—35 feet, 19 feet 4 inches, 20 feet, and 7 feet 6 inches span. It rests on a solid rock of limestone; the water in the river flows through the large arch, under which there is a deep chasm cut out of the rock 30 feet in depth, caused by the incessant rushing of the water from the falls above, which descend with great violence and rapidity, falling, from the surface of the water at the Eel Weir to the level below, 15 feet in the distance of 100 feet in length.

The arches are evidently too small in capacity for so great a body of water rushing down during the floods, at which times it shakes the bridge very much, making it appear in danger of being carried away.

I would recommend a new bridge being built at this place, in a more direct line with the entrance of the town, with stone piers and abutments, and a cast-iron arch of 100 feet span, with two side arches of stone, 30 feet span each.

The Eel Weirs at the top of the fall are a great obstruction to the free passage of the water, being built of stone, and forming solid walls about 4 feet 6 inches high, and 4 feet broad at the base, by which means two-thirds of the distance across the river is blocked up. These walls or weirs should be cleared entirely away, and a wall erected about five or six inches below the summer level, and 1,100 feet in length, according to the form described on the drawings. The proposed site is a very favourable one for the purpose, being of solid limestone rock—the surface will require very little levelling or preparing, and upon an average one course of stone will be sufficient to build the Dam from one end to another; for this purpose and also for building the proposed bridge there is abundance of flat bedded stone on the spot.

The falls of water at this place are remarkably fine and well worth attention, as they present several such sites for mill power as are rarely to be met with.

The old corn mill at the end of the bridge, which is now working to great disadvantage, will require to be removed (to make way for the proposed weir) to a far better site to be selected.

The three channels of the river course leading to the dam will require to be deepened from one foot six inches to two feet, which can easily be effected, to allow the water to flow freely to the dam; also the point of rock below the line of the proposed dam should be taken off to allow the water to escape to the chasm below. Above the dam there are several good sites for landing places and quays for Steam Packets and Trade Boats.

The channel of the river from Belleek to Roscor, entering the lake is fine, and strait, and of sufficient width. There are several shoals which are composed of gravel and clay, besides the Carry Eel Weir, which is similar to the one at Belleek, (formed of stone) and dams up the water in a much greater degree, causing a head of from one foot six inches to two feet during the floods.

The above shoals and Eel Weirs require to be removed to the breadth and depth shown on the plans and sections, viz., 200 feet wide, and seven feet deep.

The shoal at Portora is formed of gravel and clay, and will require to be deepened as shown on the plan and section.

The West bridge at Enniskillen is of recent construction, and built of rubble masonry, ashlar quoins and arch stones, string courses and parapet for fixing the railing; it has three arches of 45 feet 6 inches span each; segments of circles rise 15 feet 6 inches, and 19 feet 6 inches in height from the surface of water to soffit of arches; piers are 11 feet thick. I was informed by Mr. Maguire, the builder, that the west abutment is sunk 6 feet under the bed of the river, and the other abutment and the two piers 3 feet. The water-way under the arches is very shallow, and the piers and east abutment would require under-pinning, as shown in the elevation; and the channel both above and below the bridge, as well as under it, requires deepening from opposite the Castle to the deep water near the Distilleries below the bridge.

There are several encroachments on the river at this place, in the shape of walls and quays, which should be taken down, so as to give the river its original sectional area.

The East bridge is an old structure and built of rubble masonry, it is composed of five arches of the following dimensions, viz., 22 feet 3 inches; 24 feet; 23 feet; 26 feet; and 21 feet span, and from the surface of the water to the soffit of the arches is 17 feet in height. At this time nearly all the arches were dry, with the exception of one of them, through which small boats might pass. I would recommend the bed of the river under the arches to be deepened and the piers under-pinned.

There are several shoals in the river in the East Channel, which require deepening, particularly at Boston's Ford.

The Eel Weirs at Dane's Weirs appear very formidable erections which almost choke up the channel of the river, merely leaving a small space of about 20 feet in width for the boats to pass through. In other respects, also, it forms a very difficult channel for the Navigation at any time; but particularly so in the winter season; and when the head of water is great, and is necessarily attended with much danger to the boats navigating up and down stream. In summer the boats are required to be lightened, in order that they may be enabled to pass over the shoal. The Eel Weirs are constructed according to the form represented on the plan, and composed of piles, stakes, &c., and made to close with wattles, &c., that few fish can pass through the eyes or gaps. The bed of the river where the Weirs are erected is very shallow, and is composed of clay and gravel.

The banks of the river at this place are high and slope towards the river's edge.

This shoal and Eel Weir, and the shoal and contraction of the Bridges at Enniskillen, are the principal obstructions in this quarter, and which cause the lands and property on the Upper Lake to be inundated to a great extent—these Eel Weirs to be cleared away, and the shoal deepened.

In case the Weirs cannot be purchased for a reasonable sum, I would propose making a cut across the bed of the river near Lisgoole Abbey. The line I have selected is very favourable for this purpose; it would lessen the distance considerably, and might be done for a comparatively small sum. At the same time I would prefer keeping by the river channel, although the distance is greater; still it would be easier accomplished and would keep the channel wider, so as to give every facility to the Drainage and Navigation.

The channel of the river from Dane's Weirs to Carry Bridge is fine and open, with the exception of a few small ridges or shoals of gravel, which can be cleared away in the course of a week, with a good Dredging Machine.

Carry Bridge forms a great obstruction to the navigation and drainage; in fact it can scarcely be called a bridge, as the opening is but 12 feet wide, and 10 feet high, the remaining part being a long wall forming the roadway to the island of Inishmore. In flood time this obstruction creates two feet head of water, and nearly stops the passage of the water; so that although this channel is the finest no boats are able to pass. This erection requires to be entirely cleared away, and the channel deepened according to the section; and instead of the present bridge, I propose that a new bridge be erected of three arches, each 40 feet span, the two side ones to be fixed stone arches, and the centre one of cast iron, in two parts, so as to allow steamers and masted vessels to pass at all times without lowering their chimneys or masts.

Proceeding along the western channel, the Black Rock is the next obstruction to be met with, upon entering the narrow channel, which is from 70 to 80 feet in width. There are a considerable number of large detached pieces of rocks in the sides and bottom of the river, which in summer have only about two feet water upon them, which can easily be cleared away either by blasting or lifting them out of the river with proper tackle.

There are two or three smaller ridges or shoals above this in the western channel, which are composed of clay and gravel, and which ought to be removed to the depth of 7 feet from summer water, and to the width of 100 feet, which can be easily done by the Dredging Machine.

At the ferry at Inishmore there is a fine site for a suspension bridge, which might be elevated sufficiently so as to allow masted vessels to pass. It would also be of great convenience to the county.

Above Crom Castle there are two shoals or ridges, also near Wattle Bridge, which are composed of gravel and clay, and easily removed at a small expense.

Blockson's Ford is of solid limestone rock; this shoal is a great obstruction to the free discharge of the water, and ought to be removed. This part is the most difficult to be remedied, and will require a Coffre Dam, so as to clear one-half of the river, first by blasting and removing the rock, and when this is accomplished, to remove the Coffre Dam to the other parts of the river, and clear it in like manner.

I have carefully prepared Estimates of the before-mentioned works, and find that the whole may be executed in a workman-like manner, for the sum of £29,797.

In conclusion, I beg to remark that I am not aware of any work or project whatever, where so much benefit might be derived at so small a cost, both on account of the Drainage and Navigation, and when it is considered that the Ulster Canal is now on the eve of completion, which connects the port of Belfast with Lough Erne: and the possibility of the projected Junction Canal, which will join Lough Erne with the river Shannon, being carried into execution, it will form a communication from the Atlantic Ocean to St. George's Channel, and as it is a work similar to the Shannon, and next to it in importance, it well deserves the consideration of the Legislature, so as to put it in every respect upon the same footing with that great national undertaking.

Trusting the foregoing Report may meet with your approbation, and the Gentlemen connected therewith, I have the honour to be, Sir,

Your most obedient and humble servant,

THOMAS RHODES.

ESTIMATE of the cost of the proposed works for the improvement of the navigation and drainage of Lough Erne, to accompany Mr. Rhodes's report, dated 13th July, 1840.

New Bridge at Belleek	£8,000	0	0
Dredging the bed of the river from Belleek to Roscor, including the clearing away of the Eel Weirs and the masonry of the proposed Weir	9,147	4	6
Dredging the bed of the river at Portora	784	14	6
Dredging both channels of the river at Enniskillen, and underpinning the piers of the bridges	1,860	19	6
Clearing away Dane's Eel Weirs, and dredging the bed of the river	2,250	0	0
Dredging the bed of the river at Black Rock	150	0	0
Excavating the channel of the river at Carry Bridge, and building a new bridge there, as shown on the plan	6,000	0	0
Excavating and blasting the rock at Blockson's Ford, and other small fords and shoals	1,604	2	6
Total amount	£29,797	1	0
N.B.—If the river course be abandoned at Dane's Weirs, and a cut made across the low lands near Lisgoole Abbey, a further sum must be added of the amount of	3,516	13	0
	£33,313	14	0

THOMAS RHODES.

In the above calculation no allowance has been made for the purchase of Eel Weirs.

FALL OF A SUSPENSION BRIDGE IN INDIA.

IT is with feelings of much regret that we announce a lamentable accident which has just occurred at Madras, attended with great personal injury to many unfortunate individuals, though, as yet, so far as we have heard, with but one loss of life. On Monday afternoon the 33rd Regiment of Native Infantry (or certain companies of that corps) were crossing the Suspension-bridge at Chintandripett, on their way to escort His Highness the Nabob, and take part in the customary procession to his father's tomb, when one of the great suspension chains at the eastern end of the bridge gave way, precipitating the roadway and the concourse of persons then upon it (about a company and a half of sepoys) into the stream below. The crash must have been tremendous, and great personal injury sustained by many. We hear that 1 Subadar, 4 Havildars, and 26 men were severely hurt and bruised, and several more slightly injured; indeed, had not the elevation of the bridge above the water been so small, and the water itself so shallow, the accident would have been attended with great loss of life. The part of the bridge which gave way was the links of the eastern suspension chain, where they pass over the friction roller of the north-eastern pier. Two of the three links have snapped across, and on examining the fracture it is evident that both, but one more especially, has for a long time been in a defective state, having a crack extending almost through it. Indeed, it seems to us that the bridge has, at some former period, experienced a powerful strain, which had partially cracked these links, weakening them so far, that the pressure of the crowd at once tore away the remaining fibres, and occasioned the whole fabric to give way. It is a fact of some importance, and one perhaps not very generally known, that a concourse of people is one of the greatest loads which can be imposed upon any structure, since it brings a vast weight within a narrow compass, and that the strain is especially severe in the case of a body of military marching in regular order. We may here observe that one of the few occasions on which we have known an English suspension-bridge to fail was about ten years ago at Morpeth, in Northumberland, when exposed to a somewhat similar strain to the one in question, being crowded by persons returning from a fair. On two other occasions, where suspension-bridges at home have given way, it has been during the passage of troops in a regular march over them,—we allude to the bridges at Broughton and Montrose. The severe strain or vibration occasioned by the measured tread of a body of military is indeed so trying to these structures, that it is considered by engineers that they will in this case bear but one-eighth part of the weight they might be otherwise safely loaded with.—*Madras paper.*

ERECTION OF A SAFETY BEACON ON GOODWIN SANDS.

THE task undertaken by Captain Bullock, of Her Majesty's steamer Boxer, of erecting a safety beacon on the Goodwin Sands, about seven miles from the town of Deal, has been successfully accomplished, by which it is hoped to avert the dreadful loss of life by shipwreck which has so frequently occurred in that part of the British Channel. To the high credit of Captain Bullock this desirable object was accomplished on Thursday, 10th ult., under his superintendence and that of Captain Boys, superintendent of the naval store deparment of Deal. Captain Bullock has been long engaged in carrying out the above object, and in the arduous duty of correcting the charts in various parts of the globe, and is now doing so under the authority of Government in the waters of England. He commenced at Westminster Bridge, and proceeded towards the Land's End, which is at present undergoing his survey. The beacon he has succeeded in erecting consists of a column about 40 feet above the level of the sea, having cleets and ropes attached to four of its sides, with holds for hands and feet. At the summit of the column is attached a gallery of hexagon form, made of trellis work, and capable of holding 20 persons at one time. Above the gallery, and in continuation of the column, is a flagstaff 10 feet long, thus making the entire beacon 50 feet in height. The sides of the gallery are so constructed as to enable the persons in it to be covered in with sailcloth, which is reefed in and round it, and can be used at pleasure; as also an awning to pass over it, which is fixed to the flagstaff; thus entirely protecting any unfortunate mariner who may seek shelter on the column from foul and tempestuous weather. A barrel of fresh water, together with a painted bag enclosing a flag of distress, is stationed on the gallery, and the words "hoist the flag" painted in the languages of all nations on bosrds stationed round the inner part of the gallery, so that the foreigner as well as native seaman may be enabled to show a signal of distress, and obtain help from shore, which is about seven miles distant from the beacon. The means by which the beacon has been erected in so extraordinary a place as the Goodwin Sands are as follow:—the foundation of the column is several feet below the surface of the sand, and is secured in the centre of a stout oak platform, extending from it on either side several yards. This is secured by upwards of two tons of pig-iron ballast being lashed to it. In addition to this, eight stout iron bars, each six feet long, are driven obliquely on each quarter of the column, and two also put at a distance of 12 feet on each quarter, and chains attached to them, communicating with the upper part of the column and the gallery. The sands for three or four hours during the tides are high and dry, and present a fine tract of level extending for several miles. Great numbers of visitors from Ramsgate and Deal attended the erection of this tribute to humanity. The first person to mount it was Lieutenant G. C. Boyes, a young and intrepid officer, who, on reaching the summit, hoisted his handkerchief, a fac simile to a union jack. The indefatigable exertions of Captain Bullock, Captain Boyes, Lieutenants Gull and Bowes, and the other officers and men engaged in the undertaking are deserving of the highest praise, they being compelled to work for several hours up to their knees in water. Several visitors afterwards ascended the column, and testified, in the strongest terms, their approbation of this stupendous work for the benefit of humanity.—*Times.*

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

INSTITUTION OF CIVIL ENGINEERS.

March 31.—The PRESIDENT in the Chair.

The following were balloted for and elected:—John Brannis Birch, Charles Denroche, John William Power, Henry Rawnsley, and George Dobson, as Graduates.

"*On reclaiming Land from the Sea, with Plans illustrative of Works in Loughs Swilly and Foyle.*" By J. W. Bazalgette, Grad. Inst. C.E.

The art of reclaiming land from the sea has been practised from a very remote period. Among the instances best known to us are Romney Marsh, in Kent; the Foss Dyke, in Lincolnshire; and the coasts of Holland and Flanders. The extreme fertility consequent on such reclamations has caused many attempts to be made, and nearly all have been successful; but none presents a greater prospect of success than that about to be undertaken under the direction of Mr. Macneil on the borders of Loughs Swilly and Foyle, in the counties of Donegal and Derry.

Lough Foyle communicates with the Irish Channel by a narrow inlet, above which it spreads over a wide tract of land, and then, suddenly contracting, joins the river Foyle about four and a half miles below Londonderry, up to which city it is navigable for vessels of 500 or 600 tons burden. The rush of the tide through such a small inlet has carried with it great quantities of alluvial soil, which it has gradually deposited on the side of the lough, and thus formed a bank which extends four or five miles in length, and is only covered by the tide at high water. In order to reclaim this tract of valuable land, of about 25,000 acres, it is proposed to construct, somewhat below low water, an embankment or sea wall, of about 14 miles in length. The tide never rises here above 12 feet, nor is there ever any swell in the lough to endanger the structure.

Lough Swilly is wider at the mouth which opens into the Western Ocean, and is consequently more subject to the effect of wind than Lough Foyle. The highest tides rise about 18 feet. Several embankments are proposed, which will reclaim altogether about 2000 acres of land; a tract already reclaimed, which is considered to be of the best quality in the country, lets at 5*l.* per acre. The measurements and soundings to ascertain the best position and requisite depths of the embankments were thus taken. A tide gauge was permanently fixed on which the range of high and low water was marked; a constant register was kept of the soundings, and the time at which they were made; these were afterwards reduced to the high and low water of any one tide. The distances were determined at the same time, by means of a pocket sextant from the boat, angles being taken between certain fixed objects on the shore, so that the exact soundings could be ascertained and laid down with great accuracy. The slopes of the faces of the embankments vary on the sea face from three or four to one, and two to one on the land side. Each has a culvert 4 feet diameter, with sluices and flood-gates, founded upon piling with tie beams, and the spaces filled with concrete, the whole being covered with planking. The gates are at the lowest level of spring tides, so as to allow of the greatest degree of drainage. The wing walls of squared rubble stone stretching on either side of the gates are founded also on a bed of concrete, 4 feet wide by 2 feet deep. These gates are to be used either to keep back the fresh water for the purposes of irrigation, or for scouring away the silt which would accumulate externally in front of them. A bed of puddle, 4 feet 6 inches wide at the bottom and 3 feet wide on the top, extends longitudinally throughout the embankments. The land water is carried away by a series of catchwater drains, which extend around the reclaimed lands at the level of high water, having sufficient fall to secure its drainage through the sluices. These drains are puddled, and have their internal faces covered with sods, at an inclination of two to one.

As there are many situations where stone is very scarce, and where timber abounds, the author has turned his attention to devising a plan of embanking applicable to such localities. It may be thus briefly described; the body of the embankment should be of clay, earth, gravel, and stones, dug from the surface and thrown up in a bank, with a slope suited to the force likely to act upon it. On the water side is placed a strong facing of fascines, 6 feet thick at the bottom and 4 feet thick at the top, embedded in the soil in an oblique direction, the dip being towards the land; they are securely fastened down by iron screws running at right angles through the whole height. The land face is covered with sods. In a country where wood abounds, this kind of embankment would be formed at a very cheap rate. In other situations, where the embankments would be subjected to greater strain, the thickness of the mass of fascines should be increased to 13 feet at the bottom and 4 feet at the top. In this case, at four feet from the front of the bottom of the slope should be placed a row of fender fascines, 3 feet wide by 2 feet high, bolted down, for the purpose not only of defending the face of the bank from the action of the sea, but for retaining all deposits left behind by it; by which means the embankment would in time acquire a natural face of soil, as is the case with some of the embankments in Holland. The average cost of this kind of embankment, including the sluices and the necessary bed of puddle in the centre, would be about 12*l.* per running yard.

This paper is accompanied by seven plans of the proposed embankments and charts of the loughs.

"*On the use of Mica, as a substitute for Glass, in the Windows of Workshops.*" By Joseph Glynn, F.R S., M. Inst. C. E., &c.

In the windows of the workshops at the Butterly Iron Works so much glass was broken by the chippings of iron, that a substitute was sought which should resist a moderate blow, and yet be translucent. A quantity of sheets of mica were procured from Calcutta, which, when fixed into the cast-iron window frames, were found to resist the blow of a chipping of iron driven off by the chisel with such force as would have shivered a pane of glass. Mica possesses both toughness and elasticity, and when a piece of iron does penetrate it, merely a hole is made large enough to allow the piece to pass, while the other parts remain uninjured. It is not quite so transparent as glass, but it is not so much less so as to be objectionable; but this circumstance is not important at Butterly, as, in consequence of the quantity of fluoric acid gas evolved from the fluate of lime used as a flux in the blast furnaces, the glass in the windows is speedily acted upon, and assumes the appearance of being ground. Mica is a little more expensive than common glass; but, as its duration promises to be much longer, it must be more economical; and if an extensive use of it could be induced, a more ready supply would be obtained—probably from Pennsylvania or from Russia, where it is commonly used for windows in farm-houses, and also on board ships of war, as it is less liable to be fractured by the concussion of the air during the discharge of heavy artillery. It can be procured of almost any dimensions necessary for ordinary purposes, as it has been found in Russia in masses of nearly 3 feet diameter. It is susceptible of very minute subdivision, as, according to Haüy, it may be divided into plates no thicker than $\frac{1}{300000}$ of an inch.

"*On a specimen of White Cedar from Bathurst, New Brunswick, sent by Mr. Churchill.*"

The specimen exhibited to the meeting was of the dimensions calculated for a railway sleeper, for which use it was proposed to introduce this timber, as it is stated to possess, in a very superior degree, the quality of durability in situations calculated to try its properties. It can be imported at about 3*s.* 9*d.* to 4*s.* per sleeper.

Mr. Hawkins observed, that he knew that species of timber well, having seen it extensively employed in the United States. It is an evergreen tree, and grows only in wet or boggy grounds, and is found most plentifully in New Jersey, Maryland, and Virginia. It attains the height of 70 to 80 feet, but is rarely more than 3 feet in diameter. The concentric circles in it are always perfectly distinct, and prove that the tree only arrives at its full growth after a long term of years—as many as 277 annular rings have been counted in a trunk 21 inches diameter, at 5 feet from the ground. The wood is light, soft, fine grained, and easily wrought. It has an aromatic odour, which it preserves as long as it is guarded from humidity. It resists alternations of dryness and moisture better than any other wood, and on this account is extensively used for shingles for roofing. They sell at Baltimore for 4 or 5 dollars per 1000. These shingles will last from 30 to 40 years. It is in great demand for household utensils, so much so that a distinct class of coopers are called cedar coopers. It is used for boat building on account of its great buoyancy. Cedar boards are sold at Philadelphia at 20 dollars per 1000 feet. White cedar rails, with red cedar posts, form the most durable kind of fence, being known to have lasted from 50 to 60 years. The rails are sold at 6 to 8 dollars per 100, and the posts at 12 or 15 cents each.

Mr. Brunel did not think it was a cheap or a strong wood. He had used it chiefly for covering locomotive boilers, as it resisted heat better than any other wood. When he purchased some there was but little in the market, and it was consequently dear.

Mr. Joseph Horne objected to its use for sleepers on account of its tendency to split so easily; but he had found it resist wet perfectly.

April 7.—The President in the Chair.

The following were balloted for and elected:—Thomas Hawksley, as a Member; William Pole and John Dickenson, as Associates.

"*Account of a series of Experiments on Locomotive Engines, more particularly on the 'England,' the 'Columbia,' and the 'Atlantic,' manufactured by Mr. Norris, of Philadelphia.*" By Captain Moorsom, R.E., Assoc. I.C.E.

The engines of which the author more especially treats were constructed by Mr. Norris, of Philadelphia, and sent by him to England, under an agreement to supply "locomotive engines of a higher power, greater durability, and less weight," than could be obtained in this country. They were to be subjected to fifteen trials within thirty days, and prove their capability of drawing "up a gradient of 1 in 330, a load of 100 tons gross weight at the speed of 20 miles per hour; and up a gradient of 1 in 180, a load of 100 tons gross weight at the speed of 14 miles per hour." The pressure of the steam in the boiler was stipulated by the Grand Junction Company (on whose railway the trials were made) not to exceed 60 lb. per square inch.

The construction of these engines is very simple, and the work plain. The boiler is horizontal, and contains 78 copper tubes, 2 inches diameter and 8 feet long each, with an iron fire-box. The cylinders, 10½ inches diameter, are slightly inclined downwards, and so placed that the piston rods work outside the wheels, thus avoiding the necessity of cranked axles. The frame is supported by 6 wheels; the two driving wheels, of 4 feet diameter, are placed close before the fire-box; the other 4 wheels, of 30 inches diameter, are attached to a truck, which carries the front end of the boiler, and is connected with the frame by a centre-pin, on which it turns freely, allowing the truck to accommodate itself to the exterior rail of the curve, and with the assistance of the cone of the wheels to pass round with very little stress upon the rails.

	Tons.	Cwt.
The weight of the engine, with the boiler and fire-box full was	9	11¼
That of the tender, with 21 cwt. of coke and 520 gallons of water, was	6	4¼
Total weight . . .	15	15½
The engine, when empty, weighed	8 tons.	

The trials were made on the Grand Junction Railway in April and May, 1839, and were continued over the whole distance from Birmingham to Liverpool, except when stopping short at Warrington to take loads; and occasionally making double trips, so as to travel the total distance of 156 miles per day. Attention was more particularly paid to the speed when ascending the gradients, which rise at the rate of 1 in 330 (16 feet in a mile), or 1 in 177 (29 ft. 4 in. per mile), and as the engines approached these gradients frequently either at an accelerated or a diminished speed, the observations were made at the points most remote from the cause of variation from uniform velocity. Some of the trials were made with such a number of empty waggons to make up the weight, that the train attained a length of nearly an eighth of a mile: this required some allowance, which was estimated at from one-eighth to one-ninth in addition to the actual weight of the empty waggons.

The extreme limit of working pressure of the steam in the boiler was 62 lb. per square inch, except for a few minutes on one occasion, when it rose to 64 lb. The usual pressure for the locomotive engine boilers on railways now generally at work, is from 50 to 75 lb. per square inch.

An analysis of the tabulated results of the several trips give these general results:—that on a plane of 1 in 330, with a load varying from 100 to 120 tons, the speed varied from $13\frac{8}{10}$ miles to 22½ miles per hour; that on a plane of 1 in 177, with a load of 100 tons, the speed varied from $9\frac{8}{10}$ miles to $13\frac{8}{10}$ miles per hour.

From the analysis it appears, that allowing in five of the trials the stipulated amount of performance to have been made, and that in five other trials a doubt may exist, still in the remaining eleven trials the exact amount of duty demanded was *not* performed.

A comparison of the journeys *up* from Liverpool to Birmingham, with those *down* from Birmingham to Liverpool, gives rather a singular result. The aggregate rise of the gradients from Liverpool to Birmingham is about 620 feet, that from Birmingham to Liverpool is about 380 feet (exclusive in both cases of the Liverpool and Manchester Railway); the difference, therefore, up to Birmingham is about 240 feet. In 7 journeys of 596 miles up to Birmingham, the engine conveyed 682 tons gross, evaporated 12,705 gallons of water, and consumed 177 sacks of coke (1½ cwt. each). In 7 journeys of 596 miles down from Birmingham, the same engine conveyed 629 tons gross, evaporated 12,379 gallons of water, and consumed 177 sacks of coke. It would thus appear that the consumption of fuel was the same in both cases, and the only difference was the evaporation of 326 gallons of water more in the journey up than in the journey down, conveying nearly the same load both ways.

The author remarks, that in the early stage of his observations on the engine, he would have inferred that, from the mode of construction, it was not calculated for high speeds, such as are required for the mail trains; yet that he has often seen it travel with apparent ease at the speed of 30 miles per hour; and he thinks that, with some slight modification of the working parts, engines of this construction may be made to do any duty now required from locomotive engines; and, from the small quantity of repair required during the trials (only renewing the fire-bars, which were originally intended for burning wood, and putting nine stronger ferules in the tubes), he is of opinion, that the present construction is exceedingly well calculated for heavy loads—that it may be modified for attaining high speeds—and will prove a durable and economical machine.

Captain Moorsom, in reply to some questions from several members, stated, that although the American locomotive engines had not strictly complied with the stipulated conditions, yet he considered them good, serviceable engines, and it was the intention of the directors of the Birmingham and Gloucester Railway Company to have ten of them on their line. The price of the engine complete, including the import duty of 20 per cent., is from £1500 to £1600. One of the greatest advantages of the engines is the facility afforded by the truck for going round curves—the same engineers managing indiscriminately the ordinary six-wheel engines, and the American ones are observed to go faster round the curves with the latter than with the former. Round a curve of 10 chains radius, they had gone at a speed of 20 miles per hour. They run also quite as well on a straight road. He had travelled on them between Whitmore and Crewe at the speed of from 30 to 40 miles per hour. They appeared less likely to be thrown off the rails than other engines, as in some instances they had run over the short pointers of the Grand Junction Railway—the engineer had merely felt a slight jar, but no accident had occurred. He attributed this to the truck adapting itself so readily to the rails. The coke used in the trials was the same as that in daily use on the Grand Junction Railway, and was of average quality. The mode of attaching the tender to the engine was peculiar, and he conceived it to be advantageous, as it threw a portion of the weight upon the engine and was an assistance in starting. The engines, as they are now constructed, will do well for all ordinary speeds; but if higher speeds are required, a greater expense must be incurred, and certain alterations must be made in them.

Mr. Bury conceived the chief peculiarity of the engine to consist in the end of the boiler being placed on the moveable truck, which certainly enabled it to adapt itself easily to any curve in the railway. The cylinders are in the same position as those in the first of Stephenson's engines, and the other parts are as nearly as possible identical with plain engines constructed in England. The pointers on the Grand Junction Railway are constructed and placed in such a manner as not to throw off a carriage which might run over them, and a four-wheeled engine would not have been thrown off by meeting a closed pointer. To enable him to form a correct comparative estimate of the work done by these engines, it should be shown what power was exerted at the wheels. This was a clear mode of arriving at a result and comparison with other engines.

Mr. Donkin remarked, that the flanches on the wheels appeared to be all that retained them on the rails, and that the truck turning on a centre-pin would allow considerable lateral friction, unless there was some mode of keeping the truck in a proper position when on a straight line of railway. If this kind of engine is superior to those generally in use in this country, it must be in some part of the construction which is not shown in the model or by the description. He inquired whether, in any of the four or six-wheeled English engines, any provision is made for changing the position of the axles, so as to allow of a divergence from parallelism when rounding curves.

Mr. Bury replied, that in the engines on the Leeds and Manchester Railway, although the axles were placed parallel to each other, a considerable allowance was made in the journals of one pair of the wheels, so as to facilitate the passage round curves.

The President observed, that the wheels being turned conically was of much assistance in passing curves, even although the axles were confined by the journals in a parallel position. He was aware that this threw an extra strain upon the curve rails, but that would only require more attention in securing them than on the straight line of railway.

"*Model of the Coal Field of the Forest of Dean.*"

Mr. Sopwith exhibited a model of a tract of 36 square miles of Gloucestershire, comprising the mining districts in the Forest of Dean. This model showed all the undulations of the surface, the towns, villages, and detached buildings, railways, coal and iron mines; and separating vertically through the centre from north to south, and from east and west, exhibited the geological formation down through the coal measures to the old red sand-stone: the construction is such that, by lifting off horizontal layers, the extent and position of each bed of coal is shown, with the extent of the workings in the different collieries, and on each bed is marked the portion that can be worked by level and freed from water by natural drainage. This coal tract forms an elliptical basin; the longest diameter of which, from N. N. E. to S. S. W. is about 10 miles, and the shorter about 6 miles, ranging round Coleford as a centre. There are about 20 beds of coal of various thickness, containing together nearly 37 feet of clear coal. The carboniferous strata crop out regularly all round against the mountain lime-stone and old red sand-stone, and dip uniformly towards the centre of the basin. This could scarcely be shown clearly, even by an almost indefinite number of plans, which induced Mr. Sopwith to project the model, the method of constructing which he described to be by framing together in squares a given number of thin strips of wood, joining them by half lapping at the intersections; on these strips, the profiles of the sections were drawn, from measurements and borings. The compartments of these skeleton frames were then filled in with lime-tree wood, as being lightest and easiest to work, and carved out to the depth of the lines drawn on the strips; by these means a series of horizontal sections fitting into each other were obtained, and when painted of the proper colours, both on the surfaces and on the edges, produced the complete model which he exhibited. The cost of it was about £30 complete. It was constructed under Mr. Sopwith's direction, and from surveys made by him for the Government.

April 14.—The President in the Chair.

The following were balloted for and elected:—James C. Sherrard, and George H. Phipps, as Members; and John Harris, as a Graduate.

"*Description of the Steam Ship 'India,' with a table of the proportions of large Steam Ships.*" By Lieutenant E. N. Kendall, R.N., Assoc. Inst. C. E.

This vessel was built at Greenock by Messrs. John Scott and Sons, and the engines were constructed by Messrs. Scott, Sinclair, and Co. To render her eligible as a packet ship between London and Calcutta, *via* the Cape of Good Hope, the timbers were lengthened so as to admit of the quarter deck and forecastle being raised 2 feet more than is usual; by which means a flush deck was formed along the whole length of the vessel, 200 feet by 29 feet, materially adding to the comfort and convenience of the passengers.

The long flat floor, with straight sides and fine ends, adopted in all the best of the Clyde-built ships, for the purpose of attaining a considerable speed with comparatively small power, and uniting with a light draft of water a good capacity for cargo or passengers, has been adhered to, although the established usage on the Clyde of making the length six times the beam has been somewhat exceeded, without impairing the speed, as the voyage from Greenock to London was made in 86 hours, against a strong head wind during a considerable portion of the time.

The rigging is fitted so as to combine lightness with strength, and the facility of making every thing "snug" when steaming against the wind; the spars being so proportioned as to carry a large spread of canvass when running down the trade winds. There are several improvements in the rigging. Two of them are particularly mentioned. 1st. The employment of iron sockets, into which the shrouds, having been tapered, parcelled, and served, are inserted and firmly rivetted. Instead of passing over the mast-head, they are attached by shackles to a series of holes along the edge of a strong wrought-iron plate or cap which surrounds the mast. This is more secure than the ordinary fastening, as it prevents all chafing or injury from the wet, besides being more compact, and allows any repairs to be more easily effected. 2nd. The mode of fitting the foreyard for coming down readily in bad weather. The truss bow is made sufficiently large to admit of the heel of the fore-top mast passing readily through it, and has on its fore-end an eye through which passes an iron bolt, 5 feet long, which is held in its position by a chain passing round the mast-head; to the lower end of the bolt is attached a chain, which passes through a swivel eye on the yard, and is drawn tight by a screw traversing one of the deck-beams. When the yard is hoisted up, it slides along the chain jackstay, which prevents it from swaying about until it reaches the bolt which enters the swivel eye, and when it is close up, the yard is slung by two short chains shackled on to the mast-head chains. The operations of striking the yard and top-mast may be thus accomplished simultaneously in a few minutes in the worst weather, or they may be replaced in the same short period.

The engines have most of the acknowledged improvements, and are fitted with "Hall's Condensers" in such a manner that they can work with them or with the ordinary condensers. The cylinders are 62 inches in diameter, with 5 feet 9 inches stroke. The diameter of the paddle-wheels is 26 feet; the length of the floats is 8 feet, divided into two parts in the depth, and fixed one before and the other behind the arms. There is an apparatus for cutting off the steam at any portion of the stroke. The boilers are of a peculiar construction, combining vertical flues with a series of horizontal fire tubes, exposing a very considerable surface so as to be worked by slow combustion of the fuel from two sets of fire-places over each other; by throwing on the coals alternately, the gas evolved from the fresh fuel is ignited in its passage over the other fire-places. A considerable economy has been effected by these means.

The paper is accompanied by a drawing of the improvements in the rigging, with plans of the vessel and engines, and a tabular statement of the proportions and scantling of a number of other large steam ships.

ON IRON AND TIMBER BUILT SHIPS.

On the Nemesis private-armed Steamer, and on the comparative efficiency of Iron-built and Timber-built Ships. By Augustin F. B. Creuze, of H. M. Dockyard, Portsmouth.

(From the United Service Journal.)

Most persons who take any interest in naval affairs will have observed, for some years past, occasional notices in the newspapers, of boats and vessels built of iron. It appears to be very probable that this material may eventually almost wholly supersede timber in the construction of boats, barges, steam, and the smaller classes of sailing vessels; and therefore any information as to the manner of building such craft, or on their qualities, and the comparative increase either of safety or danger, by the substitution of iron for timber, must be worthy of notice. The Nemesis, a steam-vessel of nearly 700 tons burthen, and built wholly of iron has been lately docked at her Majesty's Yard, at Portsmouth, for the purpose of having damages repaired, which she had sustained by striking on a rock off Scilly, in thick weather, when on her passage from Liverpool to Odessa. This afforded a most avourable opportunity of obtaining considerable insight into the details of an iron vessel, while the courteous anxiety displayed by the gentleman who built her, Mr. Laird, of the Berkenhead Iron Works, at Liverpool, and by the officer, Mr. Hall, a Master in the Royal Navy, who commands her, to give every information that was in their power, removed all the difficulties which generally attend such a task. The following particulars, as far as facts are concerned, may therefore be relied upon as correct: the opinions which may be intermingled with those facts must, of course, be received only as such. The dimensions of the Nemesis are as follows:—

Length between the perpendiculars	165
Length over all	184
Length from stem to taffrail	173
Breadth	29
Depth	11
Burthen (old measurement) tons	660

The keel-plate was laid in August of the last year; the vessel was launched in November; her engines put on board, and she herself tried in December; and, finally, she was ready for sea by the middle of January.

The vessel is built almost entirely of iron; the exceptions being the planksheer or gunwale, which is of oak 4 inches thick and 10 inches broad, brought upon and secured to a planksheer or gunwale of angle iron; the flat of the deck, which is of 3-inch fir; four beams under the deck, 9 inches square. These are forward, and support the carrick-bitts, paul-bitts, and the foremost gun. The remainder of the beams, with the exception of the paddle-beams, which are of oak, 12-inch sided and 14-inch moulded, are of iron. The knee of the head, the rudder, the paddle-boxes, and a light berthing above the gunwale, about 2 feet 8 inches high, are of wood. The coamings and fittings upon deck are generally of wood, although for these purposes more iron is used in the Nemesis than in timber-built vessels. The cabins and fittings for the officers, passengers and crew, are of wood, and are very neat and handsome.

The mean launching draught of water—with masts, yards, rigging, anchor, and cable, with the cabin fittings in a forward state—was, according to the information afforded by Mr. Laird, 2 feet 4½ inches. The mean load draught, with 12 days' full supply of coals, water and provisions, for a crew of 40 men for 4 months, and 3 years' ship stores of all sorts, with duplicate and extra machinery, is also stated to have been 6 feet.

The engines were made at Liverpool, by Messrs. Forrester and Co. The diameter of the cylinders is 44 inches, and the length of the stroke 4 feet. The estimate in horse-power for the two engines is 120. The framings or supports for the engines are of wrought iron. It is usual to have them of cast iron. The greater strength of wrought iron enables them to be made of much less size and weight, and their appearance is also necessarily lighter. The boilers may be worked either separately or together. The paddle-wheels are 17 feet 6 inches diameter to the inner edge of the rim. The floats, which are 16 in number, are 6 feet 9 inches long, and 14½ inches broad. The paddle-shaft is 78 feet abaft the fore-end of the water-line. The vessel carries two 32-pounder medium guns, one forward and the other aft, on pivot-carriages, to fire over all; and it is this which constitutes one of the chief points of interest in the Nemesis. The guns are reported to have been fired several times with an extra charge of powder, and double-shotted. The concussion has left no visible traces on the vessel; and, the experiment, as far as it has as yet been carried, certainly does not militate against the adoption of iron in the construction of ships for war.

The fore-mast rakes 2 feet in 20, and is 32 feet abaft the fore-end of the water-line. The main-mast rakes 1 foot in 20, and is 111 feet 6 inches abaft the fore-end of the water-line. The bowsprit steaves 5 feet 6 inches in 20 feet. The following are the dimensions of the spars:—

	Length, ft.	Diameter, in.
Fore-mast, from deck to hounds	42	15
Fore-mast, from head	8	—
Main-mast, from deck to hounds	42½	15
Main-mast, from head	8	—
Fore top-mast	24	10
Fore head	4	—
Sliding gunter-mast	28	6
Sliding pole	8	—
Main top-mast	33	10
Main pole	13	—
Fore gaft	23	7½
Main gaff	23	7½
Fore-yard cleated	52	10½
Fore-yard arms	3	
Fore topsail-yard, cleated	36	8½
Fore topsail-yard arms	2	
Fore topgallant-yard, cleated	25	6
Fore topgallant-yard, arms	1½	6
Bowsprit, out-board	21	15
Jib-boom, out-board	13	8
Jib-boom, in-board	13½	—

The form of the midship section may be best described by saying that it is an oblong, 11 feet in depth and 29 in breadth, with its base curved downwards 6 inches in 15 feet, to the middle line of the keel, its sides slightly curved outwards, and the lower corners rounded off in the arc of a circle to a radius of about three feet. The midship portion of the body, in which the engines, boilers and coal lie, preserves much the same section throughout its length. Forward and aft, the form becomes finer, and gradually approximates to the usual bow and stern of sailing vessels. The stern-post is plumb. The stem rakes forward of the perpendicular at an angle of 16°. It may here be remarked, that the body is throughout remarkably fair; and that an observer, standing either before the stem looking aft, or abaft the post looking forward, can detect no more difference, if any there be, between the two sides, than would be observed in a vessel built wholly of wood.

With respect to the method of connecting the various parts, strictly speaking there is no keel, although the lower plate of iron, which connects the two sides of the ship, and which is about a foot in breadth, is called the keel-plate. This plate is slightly curved, with its convex side downwards, so as to form a channel for water in the direction of the length of the vessel, under the floors. The floors are straight bars of angle iron, with one flange, four inches wide, lying horizontally; the other 9 inches deep, hanging vertically. The vertical flange is connected to the bottom-plates of the ship by 3-inch angle iron—that is, angle iron of 3 inches width of flange. Upon the upper surfaces of the floors, five ranges of sleepers, of timber 12 inches square, and extending the whole length of the hold of the ship, are laid, and securely bolted to the horizontal flanges of the floors, by 1-inch bolts, their points secured under the flange of the floor by nuts on to screws at these points. The frames, which are of angle iron 3 inches wide, are 18 inches apart along the midship body of the vessel; but forward and aft this space is gradually increased, until they become about three feet apart. The in and out flange of the frames is riveted to the vertical flange of the floors by ¾ iron rivets, about 6 inches apart. The iron plates forming the planking, or rather skin, of the vessel, are secured to these frames by being riveted to the other flange of the frames with rivets of ⅝ iron, which are distant apart about 3 inches from centre to centre.

The connection of the sleepers or keelsons, which are of red-pine timber, with the iron floors, and of the floors with the frames, and of the iron plates with these frames, may be more easily understood by reference to Fig. 1. The rivets by which the plates are secured to the frames, are put in from the inside of the vessel, and are clenched flush on the plate; the outer part of the hole through the plate being counter-sunk to receive the rivet, so that the bottom of the vessel is a perfectly even and smooth surface. The whole of the riveting is performed with rivets heated nearly to a welding heat; therefore, the contact between the surfaces of the iron is exceedingly perfect, as it is insured not only by the care applied to the riveting, but by the contracting of the rivets in cooling. The frames run up to and end upon the iron gunwale, which has been before mentioned. This is of 3-inch angle iron, with one flange horizontal, to which the 4-inch wooden gunwale is secured by screw-bolts; the other flange is vertical, and to that the upper ends of the frames are riveted. Between the wood and the iron forming this compound gunwale, felt is laid, which is so firmly compressed by the screw bolts, that the joint is perfectly water-tight. The beams are of iron, and formed by two bars of angle iron, having their vertical flanges back to back, with a bar of iron 9 inches deep and ½ of an inch thick riveted between these two vertical flanges. The deck is of fir, 3 inches thick, lying upon and being secured down to the horizontal flanges of the beams by screw bolts, the heads of which are sunk about ½ an inch below the surface of the plank, and are hidden by plugs driven down upon them with white lead. Thus the fastenings of the deck are scarcely perceptible. The points of these bolts are secured beneath the horizontal flanges of the beams by nuts on a screw. The connection of the angle-iron gunwale with the wooden gunwale and with the planking; also, the connection of the deck with the beams, and the method of forming the beams, will be more easily understood by the following sketches: (Figs. 2 and 3.)

Fig. 3.—Section of beam.

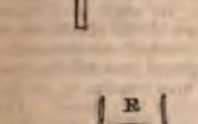


Fig. 1.

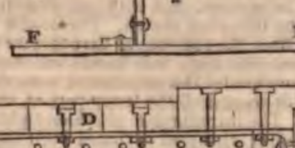
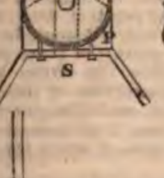


Fig. 4.



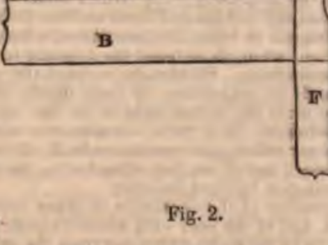


Fig. 2.

REFERENCE—Fig. 1.—S, sleeper. P, iron plate. *f* F, frame between.

Figs. 2 & 3.—D, deck. B, beam. F, frame.

Figs. 4 & 5.—R, rudder. P, port. S, stern.

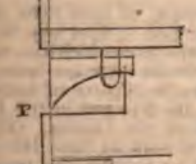


Fig. 5.

The ends of the beams are secured to the sides by angle-iron knees. The paddle-beams, which, it has been before said, are of timber, pass the sides of the vessel through what may be called sockets, formed by bars of angle iron placed above, below, and on each side of them. One flange of each bar is firmly riveted to the planking of the vessel; and the other flange is secured to the beam by screw bolts. Felt is also inserted here in the joints between the wood and iron. This appears to be a general precaution in similar connections.

The stem is formed of sheet-iron, in the same manner as has been already described for the keel. At the lower part of the stem there if a sort of socket of iron, which forms the gripe, and in which the lower end of the wooden knee of the head is inserted. It has been already mentioned that the rudder of the Nemesis is of timber; but this appears to be an exception to the general practice in these iron vessels. The main piece inclusive of the head, is usually of iron; and when of iron, is thus formed and connected with the stern-post. (Figs. 4 and 5.)

The stern is strengthened by a fashion-piece of angle iron: and the tie across the stern is by a transom, also of angle iron. The berthing all round the vessel, already mentioned as being of fir, is secured to short top-timbers of wood, which are let through the gunwale and run down about two feet below it. They are secured by two riveted bolts through the planking of the vessel; and at their intersection with the iron gunwale, by angle iron on each side.

The sheets of iron which form the planking of the vessel are about 8 feet long and 2 feet 6 inches broad. Of course, these dimensions vary according to the place of the sheet in the body of the vessel. The lower 6 strakes which form the bottom, and extend from the keel-plate to the turn of the bilge, are clinker-built. The strake at the turn of the bilge, and the 5 strakes which form the side of the vessel from this turn upwards, are carvel-built. The lands of the clinker seams are riveted with ⅝ iron rivets similarly to the lands of a clinker-built boat, without any strengthening bands. The carvel seams, and the buts of both clinker and carvel strakes, are secured by bringing the edges of the plates in contact, and riveting each edge to a strip of plate-iron, lying on and lining the inside of the joint. The seams are caulked by closing the edges of the two plates together with blows of a cold chisel. The whole of the rivets are flush on the outside of the vessel. The keel-plates are 7-16ths of an inch in thickness. The clinker-worked plates covering the bottom of the vessel are ⅜ths of an inch in thickness; and the carvel-worked plates, covering the top-sides, are from 5-16ths to ½ of an inch in thickness. The iron work is first painted with several coats of red lead, and then varnished with a patent varnish. This covering to the iron did not appear to be at all disturbed on any part of the bottom excepting where it had been rubbed off by the rocks on which she had grounded.

There are several peculiarities in the internal arrangements of the vessel. The whole internal space is separated into seven water-tight compartments, by six iron athwartships bulkheads.* Four of there—those in the wider part of the vessel—are of 5-16ths of an inch iron. The bulkhead nearest to each extremity, being of small surface, and liable to less immersion, is only 3-16ths in thickness. The wooden sleepers necessarily pass through each of these bulkheads, and they are secured where they pass through by strong flanges bolted down to them over felt, and riveted to the bulkheads, so that no water can possibly pass from any one compartment to the other. Therefore, a leak which may be sprung in any part of the bottom of the vessel, can only affect that compartment between the bulkheads of which it happens. Thus the damage caused by the rock on which she struck, admitted 4 feet of water into the compartment in which it occurred, before the leak could be stopped, but there was none in any other part of the vessel. There is a small hand-pump fitted to each compartment, the pipe from which leads into the hollow of the keel-plate. Large pumps are not necessary, as the compartment can only fill to the level of the external water, and may then be emptied at leisure; or, if the leak be greater than the discharge of the pump, may remain filled until a port is reached.

In the space between the engines and the boilers, usually called the stoke-hole, there is a very ingenious means adopted to strengthen the body, without interfering with the accommodations of the engine-room. This is the introduction of a partial bulkhead with an aperture bounded above by an erect, and below by an inverted arch of bar-iron; thus supplying by mechanical contrivance the support which otherwise could not be obtained for this part of the body, without great inconvenience. To obviate the disadvantages attendant on the small draught of water which this vessel draws, there are two sliding keels, similar in principle to those which were originally proposed by Capt. Shank, of the Royal Navy, when in command of the British force on the American Lakes, during the War of Independence. These keels are each 7 feet long, and capable of being protruded 5 feet below the keel of the vessel. They are of wood, 4½ inches thick, and each works up and down by means of a small windlass and an endless chain, in a water-tight case or trunk 12 inches wide, formed like the rest of the bulkheads, of sheet iron, and running from the bottom of the vessel up to the deck. The plates of these trunks are 7-16ths of an inch thick, and they are strongly secured by angle iron to the athwartship bulkheads, which they also serve to support.

The report of the officers on the advantage which they derived from these keels, when under sail, in enabling them to keep the vessel up to windward, and in keeping her steady, is very favourable. In fact, they are an ingenious modification of the lee-board. One of them is situated just before the engine-room, and the other just abaft it. There is also a contrivance by which the depth of the rudder in the water may be increased whenever these sliding keels are used.

Having now described the vessel, we will proceed to describe the damage she sustained by striking. When she struck, her speed is reported to have been nearly 9 knots: her average speed was 8½. The first blow was evidently received exactly in the centre of the front of the fore-foot or gripe, which was dented in about 3 inches, and split about 8 inches in its length. This blow must have been inflicted by a rock at least as sharp as the pea of a moderate sized anchor. The blow appears to have been repeated under the keel-plate, about 7 feet abaft the fore-foot, but there it only occasioned a slight, though long indentation. The principal damage was on the starboard side under the bilge, and at the station of the foremost bulkhead. The outside plate or planking was cut through by the blow having forced it on to the edges of the bulkhead plates; and the lower plate of the bulkhead was broken by this pressure. The wooden sleeper, which lay on the iron floor almost directly above the blow, was started up 1½ inches from off the floor, and the iron bolt which secured it to the floor was broken.

---

* We have been told that this method of dividing the whole length of a vessel into separate water-tight compartments is adopted in all sea-going Chinese junks. We trust our naval men engaged in those seas will keep their eyes open to these and many other interesting particulars respecting the Chinese vessels—for a description of which our pages shall always be open.—EDITOR.

The blow, to have produced such damage as has been described, must evidently have been very severe. It apparently clearly establishes that the injury affects the part struck only, for the rivets seem to have held as tight, and the contiguity of the plates of iron to have remained as perfect after the blow as before it had occurred, excepting only the plates cut by the bulkhead. There might have been a very rational doubt, before the experience this accident has afforded, whether, under such an injury, sheets of iron would not have rent almost as sheets of paper would tear; and whether the rivets would not have started by the dozen at a time, as the stitches in the seams of a sail. Several of the plates abaft the cut plates were indented in a long wavy indentation. The greatest depth of the indentation occurred at the cut, where it was 3½ inches.

The injuries were repaired by placing a shoe over the fore-foot, somewhat similar in shape to the shoe used to drag the wheel of a carriage when going down hill. This shoe was riveted strongly, by rivets passing through it and the gripe, from side to side. The two plates of the bottom which were cut, and the plate of the bulkhead which was broken, were taken out by punching out the rivets, and new plates were substituted for them. Those plates which were only indented were taken out, straightened in the fire, and replaced. A small quantity of the angle iron framing, connecting the bulkhead to the bottom, was also removed, and substituted by new. According to information afforded by Mr. Laird, the weight of new materials used in the repairs was under 3 cwt. and the expense for the materials, and wages of the smiths and riveters, about £30; which, he says, would have been diminished to £20, if he could have had the facilities that are afforded by his own factory.

It is not easy to institute any comparison between the expense of this repair and that of a similar accident to a timber-built ship; because we cannot ascertain what would have been the extent of the damage. If any timbers had been broken, which would in all probability have been the case, the expense would have been much greater. But unless timbers had been broken, the mere upsetting of the gripe of a ship, the rubbing off of a few sheets of copper, and the shifting of a plank or two, would not have involved expense much exceeding that of the repair of the Nemesis.

Before the vessel was grounded upon the blocks, sights were placed towards each extremity, 140 feet apart, with a third sight between them. By means of these sights, observations were taken before and after grounding, and the deviation from the straight line, in the length of 140 feet, was only a quarter of an inch.

Two questions now naturally arise:—1. What are the advantages or disadvantages of the substitution of iron for timber in the construction of ships? —2. To what limit may this substitution be advantageously carried? Among the advantages are the employment of a less material, of which the supply is inexhaustible, and for which supply we are totally independent of other nations. Also, the greater durability of the material, not only arising from its relative durability with that of timber, but from its requiring no metallic sheathing to protect it from the ravages of worms. Also, the greater durability of the structure as a whole, in consequence of the greater permanency in the perfect combination of its several parts, arising from the fastenings being of the same hardness of texture as the portions of materials brought into connection. The metallic fastenings to a timber-built vessel act, it must be remembered, not only chemically but also mechanically, to accelerate her destruction, immediately the close connection of the several parts is at all diminished.

These appear to be the principal advantages of iron in connection with the question, as far as first expense of material and durability are concerned. But these considerations are independent of the expense in relation to the comparative total quantities of materials required to build a ship of each sort. For it must be remembered that the iron-built vessel is of iron alone; the timber-built vessel is of timber, iron, and copper.

Were it possible to compare an iron-built ship with one entirely built of timber, setting aside the question of durability, undoubtedly the advantage would be wholly on the side of the timber-built ship. For the strength of oak is one-fifth that of wrought iron, and its weight is only one-eighth that of wrought iron. But this comparison is untenable, because of the great quantity of metal which necessarily enters in the construction of the timber-built ship, by which its relative weight is very much increased, and its relative strength diminished. By the term "timber," in speaking of a timber-built ship, a compound of timber, copper and iron is meant, having less strength in proportion to weight than the timber alone, but greater weight in proportion to strength. It is impossible within the limits of this paper to investigate the actual weights of wood, iron, and copper, which enter into the composition of a timber-built ship, in order to ascertain the exact answer to the question as to which is the heavier material in proportion to its strength, the "timber" of the timber-built ship, or the iron of the iron vessel. We shall, however, assume as correct that which we believe would be found to be so, viz. that the material of the timber-built ship would be the heavier in proportion to its strength, and shall proceed to the further investigation of the original questions on that assumption. Therefore, by the substitution of iron we obtain equal strength with less weight of material. From which advantage it follows, that if the "timber" and the iron vessel be each built for the same loaded displacement, the iron vessel, with equal strength will be capable of carrying a heavier cargo, and with greater strength an equal cargo. Also, that if a "timber" and an iron vessel be built of the same strength, and to carry the same weight of cargo, the iron vessel may be of less displacement, and consequently smaller in dimensions, or if of less displacement with the same dimensions, may be more advantageously formed for velocity and for weatherly qualities. The small dimensions involve the advantage of light draught of water, diminished expense, and less numerous crew. The diminished displacement with the small dimensions involves quicker return of capital and greater safety in navigation.

The answer to the second question, as to the limit in the size of the vessel to which the substitution of iron for "timber" may be carried, appears also to be involved in the foregoing considerations. For, if greater strength may be obtained with equal weight of material, or equal strength with less weight of material, there can be no limit short of that limitation which may equally apply to "timber." And, by an application of the foregoing reasoning to the question at issue, it appears that a first-rate may be more strongly built of iron than of timber, with the same light displacement, and equally strong built, but capable of carrying a greater quantity of water, provisions, and stores, with the same load displacement; or, equally strongly built, and capable of carrying an equal quantity of water, provisions and stores, with a less load displacement. This may appear to be a bold and startling result of our investigation: but if our original assumption be correct, it is nevertheless, within the bounds of truth. Nay, it is even an under estimate of the limit to the substitution of iron for wood in the construction of ships. For the limit to the possibility of constructing a fabric of any conceivable dimensions is necessarily dependent upon the ratio of the strength of the material used to its weight. And as this is greater in iron than in the "timber" of the timber-built ship, the limit of dimensions for the iron-built ship is more extended than the limit of the dimensions of the timber-built ship.

It may, perhaps, be necessary to repeat that the word "timber" in this investigation means the copper, iron and wood of the timber-built ship.

If we take into consideration the very few years that have passed since the first application of iron as a total substitute for timber in building ships, it is astonishing to what perfection this branch of art has arrived; and, consequently, very great credit attaches to Mr. Laird, for the intelligence and talent which he has displayed in thus adding to the manufacturing resources of this country. As the art proceeds, and becomes more general, there can be no doubt that great improvements will be made. This is said without the slightest intention of withholding from Mr. Laird the high meed of praise which is so justly his due. In speaking of the progress of improvement, we are too prone virtually to set bounds to its advance; forgetful of the fact that perfection being unattainable by mortals, it is a mere abstract term, meaning one thing yesterday, another to day, and another tomorrow. One improvement, and that probably not an unimportant one, would be the diagonal arrangement of the plates or planking of the vessel, and also of the angle iron frames. Iron offers greater resistance to compression than to extension. And bar-iron offers greater proportionate resistance to extension than plate-iron. These facts, which have been ascertained by experiment, enable us to determine upon the positions in which to place the plates, so that the peculiarities of strength of the angle and bar-iron shall be most advantageously developed. The angle iron should be placed so as to act as trusses in supporting the weight of the extremities of the vessel; the weight or downward pressure of which is necessarily greater than the upward pressure of the water. The frames should, therefore, be placed with their heels toward the midship part of the ship, and their heads inclining forward in the fore body, and aft in the after body to an angle of 45 degrees with the horizon. The plates have already been described as connected together at their edges by being riveted to strips of bar-iron. These may form the ties, and the direction of these continuous bands should be at right angles to the direction of the angle iron frames. Thus the whole body would be divided by these two series of lines into compartments; which, in the vertical part of the body, would be squares, each with one diameter vertical and the other horizontal, as in the following sketch. The double lines are the angle iron frames, the single lines the continuous bars to which the edges of the sheets are riveted. Of course, the angle iron frames will receive the rivets of one series of seams, and therefore by this adjustment some small weight of iron will be saved.

The floors and all the lower part of the vessel may remain as in the Nemesis. The introduction of water-tight bulkheads is very good. This has been before attempted in timber-built ships, but has failed, from the ignorance of the projectors of the nature of the pressure of water. They assumed that a caulked bulkhead of three or four inches in thickness, that would be quite adequate to resist the pressure of a small depth of water, would also be of sufficient strength to resist the pressure to which it would be subjected by deeper immersion. Bulkheads, to resist the pressure of water, must increase in strength in proportion to their depth below the surface of the water. This fact must not be lost sight of in the construction of these water-tight iron bulkheads. It is not of consequence with small draughts of water; but when larger and deeper vessels are built of iron, it will become a question of importance; and if not duly attended to, the idea of safety from water-tight bulkheads may be most delusive.

The question of the durability of these vessels, of their little liability to accident, and of the ease with which damage done to them may be repaired, appears to be very clearly proved from the experience which has already been obtained on these points; and this is not little, for there are boats built by Mr. Laird in both North and South America; in all parts of India, and on the Euphrates and the Indus; in Egypt, on the Nile and in the Mediterranean; on the Vistula, on the Shannon, and on the Thames. One of these boats on the Savannah has been constantly at work for these last six years without any repair; which is a great test, if we consider the frequent, constant caulkings required to preserve a timber-built ship. There is also a steam-yacht built of iron, the Glow-worm, the property of Asheton Smith, Esq. This vessel has made the passage from Bristol to Carnarvon, a distance of 210 miles, in 18 hours. In the report to the House of Commons on steam-vessel accidents, we find the following stated of the Garryowen, one of these vessels:—"We went ashore about two cables' length to the eastward of the pier (Kilrush) and struck very heavy for the first hour. The ground under our weather-bilge was rather soft clay, covered with shingle and loose stones, some of them pretty large. Under our inside, or lee-bilge, the ground was very hard, being a footpath at low water. I was greatly afaid she would be very much injured by it in her bottom, but am happy to say she has not received any injury; in fact, her bottom is as perfect and as good as on the day she left Liverpool—not a single rivet started nor a rivet-head flown off. If an oak vessel, with the cargo I had on deck, was to go on shore where the Garryowen did, and get such a hammering, they would have a different story to tell. . . . Out of twenty-seven vessels that got ashore that night, the Garryowen is the only one that is not damaged more or less."

Colonel Chesney, the commander of the Euphrates expedition, writes thus of the iron vessels which were employed on that service:—"It is but right to tell you that the iron vessels constructed by you far exceeded my expectations, as well as those of the naval officers employed in the late expedition, who would one and all bear testimony anywhere to their extraordinary solidity; indeed, it was often repeated by Lieut. Cleaveland and the others, that any wooden vessel must have been destroyed before the service was one half completed; whereas the Euphrates was as perfect when they laid her up at Bagdad as the first day she was floated. As I am now occupied in preparing a work on the expedition, I shall have a better opportunity than the present of doing justice to the subject of iron vessels, for it is my belief that they will entirely supersede wood, on account of their comparative strength, cheapness, and durability, whenever people are satisfied that their only disadvantage—the free working of the compass—has been overcome.

REVIEWS.

Seville and its Vicinity. By FRANK HALL STANDISH, Esq., Author of the "Shores of the Mediterranean," &c., 8vo. London, 1840. Black and Armstrong.

"THE work now presented to the public," we are told in the preface, "contains an enumeration of almost all the Convents and Public Buildings, which existed in Seville during the last century, with their most remarkable contents in the present;" it is accordingly one, far more calculated to interest architectural and antiquarian readers, and those who study the history of art, than the public generally; for the description of the Alcazar and Cathedral alone, the one a splendid monument of Moorish, the other of Gothic architecture, extends to somewhat more than sixty pages. In fact, a considerable mass of information relative to architecture and the other arts, and to many Spanish artists, is here presented to the English reader, which has hitherto been hardly accessible to those who are unacquainted with Spanish. Instead of being as its title alone would, perhaps, lead us to suppose, a traveller's sketch of the city and its inhabitants, this volume is altogether topographical in form,—and so far rather a phenomenon in these days of 'light reading.' It is in fact rather one for study and reference, than for off hand perusal; and therefore we conceive, ought to have been furnished with that now almost obsolete appendage, an Index. Neither is that all we here desiderate, for we conceive that the Alcazar and the Cathedral might very properly have been made to furnish something like disquisition as to the Moorish and the Gothic architecture of the Spanish peninsula generally; and so also would the Lonja (here printed throughout Louja), or Exchange, have afforded an opportunity for discussing the peculiar character of the style transplanted from Italy in the 16th century. Something of this kind would have relieved the dryness of the work which is written too much in the usual technical Guide-book style. As it is, the volume is too much of a mere catalogue raisonné of buildings and pictures, and therefore likely to be considered dull by the many, and tantalizing by the few for whom it seems to have been more particularly intended; for as there are no illustrations of any kind—not even so much as a general plan of the city to enable us to form some distinct idea of its topography, little positive information, except as to historical facts, and names and dates, can be collected from it. Nor do we, we must confess, understand why so many minor—not to call them trivial, circumstances should have been brought forward in regard to a place so very unlikely to be visited by English travellers, and which requires to be described to the English public quite as much by the pencil as by the pen.

At present only one or two of its buildings are known to us, and those very imperfectly—the Giralda or Tower of Gever, some portions of the interior of the Cathedral, the Patio de Naranjos, the Sala de los Embazadores in the Alcazar, the Golden Tower, &c., which we meet with in Roberts' Spanish Sketches, and the Landscape Annual, and which are certainly calculated to excite a vehement desire for a complete acquaintance with those edifices, and with similar information as to others. Though not to be compared with the Alhambra, the Alcazar alone would supply materials for an architectural volume, if we may judge from the Sala above mentioned, and from some other views of the edifice, which we lately met with in a recent French publication, whose exact title we do not now remember. As to the Cathedral, we are here told the architecture is of all classes—Arabic, Gothic, the 'Plateresco,' and the Greek-Roman; yet, although all these are jumbled together, and an abominably unsightly "grand entrance" has been recently attempted—fortunately, not finished, by a Sevillian architect, Cano, and a good deal of the outside walls are left rough, "nevertheless, of all the cathedrals I have seen, this is the one which, upon the whole, has most pleased me in Europe," says the author. After this we naturally look for some vindication of such opinion—for some remarks that would explain to us, in what its particular charm and merit consists, more especially as we are told that, "the interior of this temple is of the plainest Gothic."—However, provided too much be not expected from it, we can recommend this volume to those—their number, we fear, is but small—who have not the means of consulting Ponz and Cean Bermudez, yet are desirous of obtaining more minute information relative to Seville, and Spanish art and artists than English publications will supply. For our own part, we greatly regret that Roberts did not return to the Spanish Peninsula, and devote his pencil to illustrating and recording the, at the present almost unknown, treasures it contains, in the class of architectural and picturesque objects, instead of proceeding to the Holy Land which is not exactly the land best fitted for the display of his talent. At all events, we hope that in these days of travelling, some other artist will visit the Spanish territory, and return with a portfolio well stocked with architectural subjects there to be met with in profusion, and of which we have, as yet, had no more than a mere whet—a slight foretaste, a provocative that is in itself quite provoking.

Egerton's Views in Mexico; being a Series of Twelve Coloured Plates, executed by himself from his Original Drawings. Large Folio. London, 1840. D. T. Egerton.

IF it was not every one who could afford to visit Corinth, so neither have all of us, even in this age of steam navigation, the means or opportunity of taking a trip to Mexico; although in the course of another generation such a trip may become a very ordinary feat, and that too, in a still more expeditious mode than that by a sea voyage across the Atlantic,—to wit, in a balloon, should the experiments which are now actually making, to prove the practicability of such mode of travelling, be found to realize the sanguine expectations of its projector. In the meanwhile we are well content to take our ideas of Mexican scenery and vegetation,—of the costume of the people, of their habitations and cities, from Mr. Egerton, an artist who has not merely visited, but been long resident in the country, and whose drawings are no less attractive as landscapes, than they appear to be faithful and characteristic as local portraitures of the sites they represent. We say seem, because of course we cannot pledge ourselves, as eye-witnesses, to their veracity; but they certainly do bear very strong internal proofs of it, not only the general physiognomy of the landscapes and buildings, bearing testimony to it, but more especially the plants and shrubs in the foregrounds, whose particular characters are clearly discriminated.

Looking at these views as imitations of the original drawings, we may place them among the most successful attempts we have ever met with, to give the effect not of mere tinted ones, but the depth of tone, the vigour, the surface, and the peculiar execution of the modern school of water-colour drawing. Therefore, though the work is much higher in price than any of the masterly productions in lithography that have of late been published, it cannot be called dear, considering the great dimensions of the plates, and the time, labour and care bestowed upon the colouring, which has been executed under the artist's immediate inspection. Nay, as compared with what is frequently asked for a single drawing, not at all of more value as a work of art, than one of subjects forming this set, it may be termed cheap. One great advantage, too, attending the form in which they are done up, namely, their being a series of separate drawings mounted upon card board, and put into a portfolio,—is that any one or more of them may be selected and framed, and would then scarcely be at all distinguishable from an original or autograph production of the kind. A separate sheet of letterpress descriptions forms a very suitable accompaniment to the engravings, for the information it affords gives additional interest to the subjects it explains. Perhaps we cannot do better than quote by way of specimen the description of the first plate, the city of Puebla, as it commences with an observation that meets an objection very likely to be made by those who do not take into account the peculiarity of the climate where the scenery lies.

THE CITY OF PUEBLA.

In representing scenery within the tropics, where the atmosphere is so highly rarified, more particularly in situations that are considerably elevated above the sea, it is quite impossible to convey, to the inexperienced eye, an adequate idea of distances, which always appear to be lessened: and the hardness of outline, with the distinctive form of objects, as exhibited in faithful pictures, frequently subject tne artist to the imputation of a want of skill :—thus, in the two mountains shown in this subject, they appear to come forward upon the eye, whilst their bases are at a distance in a straight line from the foreground, of about thirty miles. The sides of these mountains are covered with deep forests, extending from the base to that point where vegetation ceases to exist; this may be observed in the picture, where the grey tone of the forest is succeeded by a warm sand colour, and the higher elevation is distinctly marked by the snow, which perpetually covers the summit. The loftiest of these mountains, called Popocatepetl, stands at an elevation of 17,884 feet above the level of the sea (nearly three miles and a half), and at about 10,684 feet above the city of Puebla, from whence the crater of this volcano is plainly visible, the edge of which falls considerably towards the south side; it still burns feebly, and the surrounding country bears the devastating marks of violent eruptions; though no records have been kept of these. The neighbouring mountain, called Iztaccihuatl, is supposed to be an extinguished volcano—and these two form the barrier to a direct communication between Puebla and the Capital, which places are distant from each other about 70 miles, the former being 162 miles from the port of Vera Cruz. The city, a small portion of which only is seen in the picture, is the richest bishoprick in the country, and is celebrated for its fine cathedral, the altars of which are decorated with the most costly magnificence.

As likely to be interesting to several of our readers, we shall also copy what is said of the Mine of Rayas.

INTERIOR OF THE MINE OF RAYAS.

This mine, situated at Guanaxuato, is esteemed the richest upon the *Veta Madre* (mother vein). One of the principal *levels* is shown in this plate, "the cañon of San Cayetano." This excavation has been formed by blasting the rocks, amongst which the silver is disseminated in minute particles; occasionally threads and lumps of silver are found in a pure state, but these form an insignificant proportion to the mass. The principal shaft of this mine is of large dimensions, being 31 feet in diameter, of an octagonal form, and 464 *varas* deep (1,276 feet). In the lower workings, the air is very confined, and the heat rather oppressive, the mean temperature being 85° of Fahrenheit; in the level represented here it is 80°. The *Tenateros* (carriers) who convey the ore from the different workings to the bottom of the shaft, from whence it is raised to the surface, are paid according to weight and distance; they are, from long practice, rendered capable of bearing great weights—the average allowance is 9 or 10 *arrobas* (225 lb. and 250 lb.); but there are instances of their far exceeding this; and in the *Despacho* (office) of Santa Rosa, belonging to this mine, there are two masses of ore which have been brought up entire by one man, in successive journeys, one weighing 18 *arrobas* (450 lb.), the other 22 *arrobas* (550 lb.), which are kept as trophies of human strength. When it is considered that 300 lb. is the average weight that a mule carries, and that those masses were brought from the level shown in the plate, to a distance of 260 *varas* (nearly as many yards), with an ascent of upwards of 100 *varas*, it will appear more extraordinary. The miners, who are voluntary workmen, are a very superstitious race; they are subject to many accidents, from blasting, rush of waters, descending and ascending the shaft, &c.; but the limits of a short description cannot convey an adequate idea of the life of these singular men, which is full of stirring incidents.

The Palace of Architecture: a Romance of Art and History. By GEORGE WIGHTWICK, Architect. Imp. 8vo. 67 Plates and 143 Woodcuts. London: Fraser, 1840.

IF the singularity of its title is well calculated to excite curiosity, and the splendid appearance of the volume itself is likely to secure for it admiration, the author's aim is by far more singular than the one—more admirable than the other; while some of his opinions and remarks are so striking as to be absolutely startling. It is not the least extraordinary circumstance of all that, although a professional man, Mr. Wightwick is so free from professional prejudices, so ultra-liberal, in fact, that he is in danger of being considered highly illiberal in many parts of his book by his brother architects. That he is not at all anxious to have the art kept, as heretofore, a sort of close borough, is evident from the very first; nor is there any mistaking his object, which is nothing less than to divest the study of architecture of that kind of freemasonry, mystery, and mystification, in which it has hitherto been kept shrouded from the million. Nay, he even goes so far as to express the hope "that quackery may no longer practise its meretricious frauds, to the delusion of ignorance;" a pretty broad hint that there has been a good deal of quackery in architecture ere now, and that such quackery has succeeded mainly in consequence of the inability of the public to detect it, and to discern plodding feebleness and sterility of mind just *plated over* with the specious, yet superficial surface of art. In time, perhaps, the plating wears off, and people begin to be ashamed of the sorry stuff which they had been taught to look upon as sterling metal; but in the meanwhile the mischief has been committed, and the public have no other means of consoling themselves for the despicable specimens of taste foisted upon them, than by sneering at the want of discernment on the part of the generation which could allow itself to be so duped, notwithstanding that they themselves are probably gulled to the very same extent, although after a contrary fashion. Had the course here recommended by Mr. Wightwick been adopted a century ago, and had the study of architecture been considered one of the requisites towards a polite education, the art itself would, in all probability, have been in a very different condition among us from what it now actually is. If executed at all, many things that have in their day obtained praise, would have incurred derision at the very first. Hardly would such men as Taylor and Wyatt have obtained the celebrity they did—more to the astonishment of the present time than to the credit of their own—for their talent, more especially that of James Wyatt, is now beginning to be better understood, and rated at its actual worth, which is exceedingly low indeed, for he was at the best a complete mannerist, while his manner was at the best completely insipid. Nash's reputation is now scarcely worth a bawbee; nor would we give much for the reversion of that of Sir R. Smirke, whose frigid soulless *classicality* has impoverished our modern architectural style most deplorably.

Should Mr. Wightwick's counsel be followed, the next generation will not, we conceive, be put to its shifts, so much as the present one, to find competent judges in matters of architectural taste; whereas now it is universally complained that hardly two or three non-professional persons can be found at all qualified to be entrusted with the selection of designs at competitions. So far, therefore, Mr. W.'s book is eminently calculated to be of service, by inducing people to discard the fatally absurd prejudice that the study of architecture concerns architects alone. Either it is, or it is not, a fine art; in the latter case, of course it deserves to be applied to only by those who practise it; but in the other, it claims the attention of all who make pretensions to taste, and the more extensively it is cultivated the better, else how can the public sympathize with it?—how can they appreciate or enjoy it?—how should they encourage it properly, or wherefore should they encourage it at all? because a public without taste for architecture does not need architects, but merely builders. All this we take to be pretty self-evident, whether it be exactly palateable or not.

To ourselves it is most satisfactory to find that there is at least one individual in the profession, who, with no ordinary degree of eloquence and persuasion, strives to induce non-professional persons to apply themselves to architecture as one of those pursuits which of themselves reward the student. We do not say that others have actually dissuaded from such attempt, or that they have not occasionally acknowledged the ability and services of amateurs; but it has been as if they looked upon the latter as a class necessarily limited to a very few individuals, and those chiefly wealthy ones. Never do they seem to have contemplated the possibility of that class—if it now deserves the name of one—becoming a numerous one; for never have they uttered any exhortations to that effect; never have they recommended that architecture should be taught at schools and colleges: never have they pointed out what course of study in it would be most suitable for such purpose. Without doubt every one has always been at liberty to make architecture his hobby if he pleased, but then, whenever it has been taken up at all, it has been entirely through accident or fortuitous circumstances, and not in consequence of any provision made for the study in the usual course of previous education. The question, then, is, why has no provision of the kind been made? how happens it that architecture has been completely overlooked as a branch of education? And to this question no one, we will venture to say, is prepared with an answer, for the reason that no one has ever thought of its being ever asked. Shall we say it is because architecture has nothing whatever to recommend it as an elegant and liberal pursuit to those who do not intend to follow it as a profession? and because, although nominally accounted one of the fine arts, it has nothing in common with the rest, being, in fact, no better than a dry, plodding, mechanical calling, fit to be left entirely to those whose trade it is? It may be so; at any rate such is the light in which it is generally considered, though architects would fain have the world believe quite the contrary.

Let us disguise it as we may, the truth is, there is very little relish for art in this country; for instead of any pains being taken to instil a taste for it into young persons, they and all others are left either to pick up their notions of it as well as they can, or else to remain all their lives in a "gentlemanly ignorance" of it, while they find more congenial food for their taste in dandyism or politics, or on the turf and at the gaming-table—perhaps in amusements *à la Waterford*.*

---

* It would not be amiss were we to look at some of the portraits drawn of us by foreigners. It was not very long ago that we met with a very long

> article in a German review which animadverted most severely upon our present extraordinary predilection for "mob literature," upon our Jack Sheppard and Oliver Twist mania, and upon productions of that Newgate school of literature which is calculated only to beget a low and scoundrelly sympathy with crime and vice:—an odd taste for a people who give themselves the airs of being the most moral nation on the face of the earth. Hardly more complimentary are some of the remarks we have met with in foreign publications, in regard to our feeling for art, and the mode in which we profess to encourage it. As far, too, as architecture is concerned, English buildings do not always make that favourable impression upon foreigners which it were to be wished they should do.

Whether this state of things is at all to be regretted or not, certain it is that we have no reason to be surprised at it; whereas it would be almost miraculous were we to find a strong love of art diffused throughout the public without any pains being taken to implant it, or there being anything in the present constitution of society to cherish a passion for art, as was formerly the case in this country, as well as others, when art was munificently patronized by the church. There is now scarcely any inducement for those who have leisure, to devote any of it to architecture as a recreative study, for they, no doubt, know that they would have very few to sympathize with them, and also that they may be wholly ignorant of it with perfect impunity.

Possibly the time—should it arrive at all—is not very far distant, when an acquaintance with the principles and elements of architecture will be considered nearly as indispensable as several other things that are now taught as accomplishments. At any rate it will be no fault of Mr. Wightwick's should such not prove to be the case, the primary object of his work being to gain proselytes to the study from among the educated of both sexes, although hitherto there seems to have been a kind of Salic law, excluding females from it altogether. Yet wherefore an art which depends so much upon the beauty of forms and their combinations, and the study of which tends so greatly to correct and refine taste generally, should have been considered unsuited for the female sex, or else far above their mental faculties, is one of those questions that when considered without prejudice, startle us by there being any occasion for putting them at all. There can be little doubt but that indirectly at least, female taste—or rather the want of it—has been more influential than is suspected, upon architecture; for almost one entire branch of the art has in consequence been exterminated—or rather checked and prevented from developing itself; that which should properly belong to the architect and the artist, being allowed to devolve upon the upholsterer. We cannot, however, allow ourselves to enter here upon a topic that would lead us on to a very great length, and shall therefore merely observe that architecture had been previously recommended as a very suitable study for females, both in the Foreign Quarterly and Loudon's Architectural Magazine; therefore supposing there is any absurdity in such view of the matter, it is not here broached for the first time by Mr. W., although his advice in that respect, will, no doubt, appear entirely novel to most of his readers. Whether so considered or not, we trust that it will not be altogether thrown away; and coming directly from a professional man, it may probably, have greater weight than it else would. So far from objecting to it ourselves, we could wish that the author had expatiated more fully upon this particular point, and had gone so far as to advise that those who have any inclination for the study at all should go through such a course of elementary lessons with an *Architecture-master*, as would familiarize them with all the technicalties of architectural drawing and detail, and thereby enable them to carry on their studies afterwards by themselves. Until an acquaintance with geometrical representation be formed, and a relish acquired for that as well as perspective delineation, little progress can be made in the pursuit; and although such mode of study may at first sight appear formidably tedious, it in fact opens a source of interest unknown to those who for want of such instruction see only general masses and forms, without taking any note of minor traits which confer individual character and expression.

Why then not call in the Architectural Master?—Because, people will say, it would be so very odd, and after all the acquirement itself would be a useless one, especially to ladies. This last ought of course to be admitted as a most reasonable reason; yet when we consider by how many exceedingly useless pursuits women now suffer themselves to be engrossed, that of architecture would be such a trifling peccadillo, that it need not weigh heavily upon their utilitarian consciences. It would seem, however, that there is at least one lady, and she too of high rank, who does not consider architecture—that is, the æsthetic or artistical part of it, either an unfeminine or a vulgar study; for as Mr. Wightwick has dedicated his volume to the Countess of Morley, we may presume that in her he has met with that example which has encouraged him to recommend the study to others of the sex. If it be true—but as we have only newspaper report for it, it is just as likely to be false,—if it be true, we say, that her Majesty is now taking lessons in etching, we hope she will, by and by, condescend to take some also in architecture, because there her taste might prove of singular benefit, and might encourage works that would redound to the credit of the age and of the nation, whereas her Majesty's etchings are likely to have just as much effect upon art as those of any other young lady—and no more. Had George IV. possessed a tithe of the taste for which he was so liberally credited by flattery, Buckingham Palace would have been a worthy architectural monument of his reign, instead of being, as at present, an ignominious one, and even Windsor might have, perhaps, been better by several degrees, than it now actually is. If there be any one of the fine arts which it is more especially desirable that a sovereign should be able to appreciate, it is surely architecture, because its more important productions are durable, and ought therefore to be noble, memorials of the period when they were erected.

If we have thus far said very little in regard to the volume before us, it is Mr. Wightwick himself who has diverted our attention from its contents generally, by adapting it to those who are without the pale of the profession, and by his endeavouring to enlist as many as he can into the volunteer corps, of amateurs. And if we have confined our attention to this single point, it is because we consider it to be one of paramount importance, and perhaps go further in regard to it than even Mr. Wightwick himself, being of opinion that unless the public be educated to understand and relish architecture as a fine art, it is almost hopeless to expect that it should flourish among us. We may probably bestow some further notice on this work, but lest we should not do so, we will here express our hearty approbation of the writer's intention; nor do we entertain any doubt as to his book effecting considerable good.

A Treatise on Engineering Field Work. By PETER BRUFF, C. E. Second edition, corrected and enlarged. London: Simpkin and Marshall. 1840.

In our last number we took a cursory glance at the contents of this work, we shall now proceed to point out what is additional in the new edition: in the first place we must state that the whole of the work has been carefully revised, and that there are several passages distributed throughout, which did not appear in the former edition; we shall now confine ourselves to the leading subjects which have been introduced in the present volume.

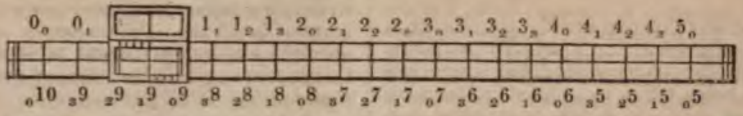
Chapter 3 is entirely new, and contains directions for conducting a survey, laying out a base line, a most important object in land surveying, and more particularly in railway surveying; for the latter we think it should be, if possible, marked out the whole length of the line by the engineer or his principal assistant, and that the connection of the work of the different surveyors should also be done by him. This chapter likewise contains some useful directions for the student in detecting and avoiding errors.

In chapter 4 we have some judicious observations on parish surveying, and remarks on Captain Dawson's directions for the surveys made under the Tithe Commissioners.

Chapter 5 contains instructions for surveying with angular instruments—town surveys and subterranean surveying.

In chapter 6 there are several hints for facilitating calculations, and various methods and instruments explained for that purpose; for our own part, we are generally averse to most ready reckoners, for in nine cases out of ten, if a person has any nouce, he will beat, by mental calculation, one who has recourse to tables and instruments, both in accuracy and time;—we, however, shall give the description of an instrument which, Mr. Bruff tells us, has lately been adopted in the Tithe Commissioners Office, and which appears to be an instrument not easily put out of order.

"The last, and most simple method, which we shall describe, and which is now in the course of adoption by all surveyors, and at present exclusively employed at the Tithe Commission Office, presents the greatest facility in performing computations, without in the least damaging the plans, by equalizing boundaries, &c., as by all the previous contrivances. The principle of the plan has long been in use by some few surveyors, but they prudently kept it to themselves, in order that the price of such work might not be reduced; but at last the method has become publicly known, and a vast reduction has taken place in the remuneration of such operations. In the first place, tracing paper of a superior quality is procured, and parallel lines, at exactly one chain apart, drawn in one direction only along the whole width of the paper. This paper is then carefully laid over the enclosure which is to be computed; the scale to which the map has been plotted is then laid on the first division of one chain—the inequalities at either end being equalized by the eye—and the distance noted. This first distance is brought forward at the second division, and the sum of the first and second at the third, and so on; thus, if the length of the first division is five chains, the scale, when applied to the second, is set on the left hand at five chains; and if the second division is seven chains in length, the right hand extremity is set to twelve chains, which quantity is again brought forward at the third division, and so on until the whole distance of a field, in strips of one chain, is ascertained, when the acreage is at once deduced, by cutting off three figures from the right hand—those on the left are acres—which are multiplied for roods and perches. An ingenious application of the above system is now in operation at the Tithe Office, by which means all calculation is avoided, and the area has merely to be read off on a scale. The following diagram and explanation will enable any surveyor instantly to practice it:



"The instrument consists of a box rule, with divisions at 2½ chains apart, and numbered 0_0, 0_1, &c.; at four of these divisions, or ten chains, it is numbered 1_0, or an acre—the reader bearing in mind that the divisions, on the tracing paper laid over the field to be computed, are one chain apart—therefore each single division, as 0_1, is a rood. There is a brass slider attached to the rule with a horsehair strained perdendicular to its length, for the purpose of equalizing the fences at the end of each strip. On this slider—which embraces rather more than two roods in its aperture—are laid off 40 divisions, on alternate sides, each way from the centre, and which are exactly the length of one rood, consequently each division is a perch. The figures on the upper side denote the acres and roods, as far as the rule extends, and are continued backwards on the lower part; the large figures are acres, and the small figures roods. Now, to apply this instrument to practice, lay the ruled tracing paper over the enclosure, and move the slider until its centre is on 0_0; place the scale in such a position that the horse-hair forms a mean line of such part of the left hand bounding fence as is included in the first strip of one chain wide, and press it gently on the paper; with the right hand move the slider along the rule, until the horsehair forms a mean line on the required part of the right hand bounding fence. Then move the instrument *altogether* on to the next division—the slider still remaining as last set—the horsehair forming a mean line, as before, with the left hand hedge; press the rule gently, and move the slider on the scale, until the horsehair forms a mean line with the right hand hedge, as before; which process is repeated until the entire length of the rule is passed over, when it is reversed, and the slider moved towards the left hand, the equalization in this case commencing first on the right hand side. When the slider is brought back to its original starting point, if there remains any further quantity, it is again moved forward to the right, as at first, the continuous measurement being easily kept up by the decimal arrangement of the contents. For example, in the position the slider occupies in the diagram—supposing it had been moved over the scale and back—the contents would be ten acres and 3 roods; and if, instead of the centre exactly coinciding with the division representing 3 roods, it was 20 of the small divisions on the slider beyond it, the contents would be 10 acres, 3 roods, and 20 perches. As a proof of the great saving effected by this instrument, we need only observe, that the price of scaling has been reduced from 50 to 75 per cent. since its introduction."

In our last number we stated that in this work, there would be found several useful hints, we shall therefore conclude by giving another extract, although it may not be new to the experienced practitioner, we have no doubt it will be found serviceable to the student.

"On the subject of reducing and copying plans we cannot be expected to say much. For ordinary purposes the pentagraph presents the readiest method, both for copying on the original scale, and also for reducing or enlarging the copy to any proportional size of the original. There are, however, several improved instruments for copying with greater accuracy than the common pentagraph admits of. The reducing of a plan by hand, is commonly performed by drawing squares of a size commensurate with its minutiæ all over its extent. Similar squares of any required proportion to the first are then drawn on the paper on which the plan is to be copied, and in every square of the copy is constructed that which is contained in the corresponding square of the original; to enlarge a plan the operation is reversed.

"A much more accurate method than the above for reducing or enlarging plans for railways or other similar purposes, is, to lay down lines of construction thereon, in precisely the same manner as would be done in surveying it; then take off the lengths, offsets, &c., with the proper scale, and replot the survey to that scale on which it is required. The usual method of copying plans by hand is to prick all the angular points and principal features through the original on to a plain sheet of paper fixed beneath it, on which the copy is to be drawn; these points being then connected—first with pencil lines—are inked in, and a tolerably accurate copy obtained: but the method is not to be recommended, from the injury it does to the original, and the incidental errors from oblique punctures of the pricker, &c. The best method of copying plans, which we are aware of, is either by a copying glass, or by tracing and transferring. That by the copying-glass is performed thus:—in a frame, which can be fixed at any inclination, is placed a sheet of plate glass; to the frame is fixed the original plan, and above it the paper on to which it is to be copied; the frame is then placed behind a strong light—or lighted candles placed below it—which enables the draughtsman to see all the lines of the original, and to trace them in ink on the plain paper without difficulty.* The second method is to make a tracing of the original on proper tracing paper; rub the back of it with powdered black lead, and fix it down carefully on to the paper on which the copy is to be made; then lightly trace all the lines with the end of a porcupine's quill, or other pointer which will trace fine lines, and a perfect copy similar to pencil will be obtained, which has then to be inked in."

We again with much pleasure recommend this work to the student, we think it the best practicable work that has been published on land surveying.

ON THE ORIGIN OF THE ARCH.

ALL must admit that any attempt to fix the date of antiquities is a dangerous task: that all who steer amidst the shadows of the past are subjects of suspicion and mistrust, is also true, Yet though I do seek the region of doubt, and, like the antiquary, revel for a little amidst problems and enigmas, I trust the importance of the subject may guarantee me in some measure from the fate predicted. In throwing out a few hints then, upon the "origin of the arch," wrapped as it is in mystery, it is not from an idea that to fix the period of its birth is vital to art, but rather that to assign to the relics and fragments of antiquity their proper age, seems virtually to guide us into the spirit of past times. Thus we shall be prevented from identifying much that is curious and singular in design, or grand in invention, with a barbaric æra; when a more civilized race might more consistently claim it.

Rome, we say, deserves credit for this invention, because Livy, in allusion to the "Cloaca maxima," remarks, that Tarquinius Priscus drained the low grounds of the city about the Forum, and the valleys lying between the Palatine and Capitoline Hills, by carrying sewers from a higher level into the Tiber. (Lib. i, c. 38.) But the drain was unfinished, and Tarquinius Superbus completed it, for he adds, "Tarquin the Proud made the great subterranean cloaca to carry off the filth of the city, &c. &c. (Lib. i, c. 56.)

Let us presume Livy to be correct, and that Tarquin really constructed that magnificent work; still we cannot conceal the statement of Herodotus and Strabo in their description of Assyrian monuments, &c. We may admit, perhaps, the cloaca maxima as a work of the Romans, but if Strabo be an authority, the arch was instrumental in the construction of the hanging gardens of Babylon, which must have been raised somewhere about 1200 years before Christ. Authorities may and do disagree as to the real author of those works, but that the pile of terraces was sustained by vast arches, raised upon other arches, seems indisputable. (Strabo, l. xvi, p. 738.) Then, again, as to the date assigned to them, whether we take Ktesias or Herodotus, still their date was very long before the building of Rome. Thus it follows that, if Babylon displayed the arch in her magnificent works, long before Romulus flourished, then Rome must (if she is to share in the discovery of its properties), at least yield in the *antiquity* of her claim to that of the Assyrian capital.

---

* We have frequently practised this method in copying railway plans and sections in the country—using common window glass for the purpose, and found a great saving of time in comparison with the common method of pricking through.

Then another question arises out of this. Can the statement of Livy be correct? May not the cloaca maxima be as Ferguson hints in his Roman Republic, the relics of some great city, on the ruins of which Romulus pitched and settled. That the arch existed in Assyria is, as far as nice authorities are concerned, certain. That two countries might discover a grand principle in construction at distinct times, is *possible*—but that the arch is exclusively of eastern origin, is *more* than *probable*. To say nothing of the magnificence of such a work as the cloaca maxima, in the ruder times of a republic, unequalled as it was in the time of Augustus, there are those who countenance the idea of a city on the site of Rome long before the time of Romulus. Virgil alludes to this; for Evander, in speaking to Æneas, is made to say:

> "Hæc duo præterea disjectis oppida muris
> Reliquias veterumque vides monumenta virorum:
> Hanc Janus pater, hanc Saturnus condidit urbem,
> Janiculum huic, illi fuerat Saturnia nomen."—Æn. viii, 355.

In another passage Virgil again alludes to this, and presumes it of Lydian extraction:

> "Ubi Lydius arva,
> Inter opima virûm leni fluit agmina Tybris."

In looking into the history of Lydia, we discover that Ninus, who married Semiramis (the probable author of the hanging gardens,) subdued the Lydians about 1232 years B.C., and it is probable that, when his second son Ezron became the king, the arts of Babylon might have crept after him, and thus the arch might have travelled with the Lydian colonists. Then, again, there are those who contend the arch was unknown in Greece till within a hundred years of the Christian æra. So that if Rome were its original source, it would seem much more reasonable to expect its application at an earlier period, since we discover the arch, even in China, in familiar and extensive use at a very early period.

Such are the doubts, I humbly offer to the curious antiquary, and without prejudice to the pretensions of Rome, would add, that there seems a disposition in us to fancy that great city to be the cradle of this important principle in construction, since in Rome we find its boldest application. Existing evidences, too, carry us back into times so remote, that we yield insensibly to this *material* impression, and hush all whispers of record and history in behalf of claims, when no remains of the past confirm them. Perhaps an abler hand than mine may yet clearly *prove* these suggestions, and discover Tarquin the elder, in his attempts to drain the city, as the finder of a hidden wonder, and not as the introducer of a novel discovery; whilst Tarquin the proud may appear only applying to the magnificence of Rome the skill of an earlier day—worthy, however, of praise for the ingenuity which detected, and the bold promptitude which applied it to the improvements of Rome.

Frederick East.

Sept. 10*th*, 1840.

THE NELSON MONUMENT.

There seems to be a pretty strong feeling entertained against Railton's Corinthian Column; and it is to be hoped that such a hackneyed and tasteless object will never be erected as a monument to Nelson, for in reality, it will prove a disgrace to Brittish art. Even at this eleventh hour it will be better for the parties more immediately concerned, to make the best of a bad bargain, and to put up with the loss of the money already thrown away, than obstinately to persist in completing an absurdity, because it happens to have been begun. The Nelson Committee ought rather to think themselves fortunate in having a very good excuse for even yet re-tracing their steps, and thus sparing themselves the obloquy, and art the discredit, that must else redound to them from such a puerile monstrosity.

Are we never to profit by experience, however dearly bought?—Must we continue to doom ourselves, time after time, to the sneers and reproaches directed against our blunders in nearly all matters of taste, by other nations?

Some may perhaps, be of opinion that quite enough has been said upon the subject already, and that any further remonstrance would be useless. We however, think very differently, being persuaded in our own mind, that it is mainly owing to want of determined perseverance in remonstrance, that so many abortions in architecture are inflicted upon this country. Or are we to be told that there is no public opinion whatever worth attending to in such matters?—that there does not as yet exist among us even one class of persons that can justly be considered as forming an architectural public? If such be really the case, the next question is, are we ever likely to have one?

As to the Nelson *bore*,—for such it now turns out to be,—there was, if we mistake not, a good deal said beforehand in the newspapers relative to the talent that would be elicited by the Competition. Talent, forsooth! Well, if there was talent, the Nelson Committee had certainly not *nous* enough among all of them, to find it out; else never would they have pitched upon such a miserable *pis aller* as they have done.—Should the Column—as we devoutly hope it will not—ever be erected, at all events a statue personifying the Collective Taste of the Committee ought to be clapped on the summit of it. Verily it deserves to be *extolled* and in no other way.

THE NELSON MONUMENT.

Sir—I am desirous of addressing you upon the subject of the proposed Nelson Monument; feeling that an unaccountable effort being now apparent to render our metropolis a laughing-stock to foreigners, it is a duty of every lover of art to raise his voice, however feeble, for the warding off of the impending calamity. I will for the most part confine myself to the examination of the question, whether an isolated column can with propriety be employed. Columns at first rude in execution, were erected by the ancients as actual supports to horizontal entablatures, and indeed according to one theory, that of Lebrun, we may say that their proportions, chosen as producing the most beautiful effect, were also those best calculated to ensure stability. The epistylia being of great length, the supports or columns were corbelled out at the top, with a view to shorten the part unsupported, and thus was invented the capital. It is erroneous, according to Sir William Chambers, and all other great artists, to employ ornaments which have not the semblance, at least, of utility, and if this excellent maxim be observed, we shall not admire a statue whose features cannot be distinguished, a capital without an architrave, and a column with nothing to support, and in fact, as I have heard it said, we might with as much propriety erect a colossal representation of the leg of our great hero. But, I am aware, there is yet a powerful argument in favour of isolated columns, viz. that they were employed by the ancients. But those who favour this opinion surely forget, that though in the columns of Trajan and Antoninus, the impropriety still exists, it is almost obscured by the ornaments and the spiral basso-relievos which, twining round the shafts, destroy in a considerable measure the idea of support. The object of the Roman structures could not be mistaken, they are evidently *monuments;* but the proposed erection will never have other than the appearance of a huge fac-simile of a small column. Surely some who argue that Roman precedent is sufficient to prove the proposed structure beautiful, pass over the numerous instances in which Roman artists have tortured and debased their plundered architecture. They it was, who totally ruined the proportions of the Doric and Ionic orders, who introduced broken entablatures and overloaded cornices, who placed order above order, and who set the order upon a lofty pedestal, and crushed it with a ponderous attic.

The truth of the saying of Aristotle, let us all hope will be manifested, and that "the people" will prove that they are the best judges of whatever is "graceful, harmonious or sublime," and I am confident that the best results would have followed, if *they* had been allowed, in the first instance, to give judgment between the competing designs. Amidst the general apathy, whilst the column is actually being commenced, an important Journal, Sir, like your's, should raise its voice, and you will therefore pardon, I hope, my trespass on so much of your space.

I am, Sir, very obediently, your servant,

A Lover of the Beautiful.

47, *Lower Stamford-street.*

COMPARISON OF STONE AND BRONZE STATUES.

Sir—I observe with regret, that the statue for the summit of the Nelson column is to be of stone, from the very nature of that material it is impossible to make a statue which can look well in such a position, and this for reasons which I think have been overlooked, not only where statues of bronze have been placed on columns, but also in the majority of bronze statues erected in our public places. An error in judgment and in taste is observable in these, which becomes particularly offensive when a statue is placed on the summit of a column, and it arises from not considering the nature of the material employed. Bronze statues are, in our times, executed on the same principles of composition adopted in marble statues, from the necessities of the latter material. A glance at the arrangement of bronze statues amongst the ancients may assist us in determining what principles of composition should be followed; in these we find that trunks of trees, masses of drapery, and the various contrivances necessary to strengthen marble statues, and *only tolerated* because *necessary*, are entirely dispensed with, and where drapery is essential to the subject, it descends in peculiarly light folds, and is generally tighened round the ancles, every advantage of the material being taken to imitate the thinness of real drapery. There cannot be a doubt of the propriety, and consequently of the taste of this arrangement, and an examination of the heavy dark masses in our streets and squares cannot fail to impress us with the conviction that the ancient practice is the proper one. The consequences where such masses are placed on the summit of columns, are peculiarly disastrous; it cannot, however, be doubted that bronze is the material which should, at all times, be adopted in such situations. We find, by the examination of ancient coins, that the statues of Trajan and Antoninus, placed upon the summits of their respective columns at Rome, were of a lightness in the arrangement wholly unattainable in marble or stone; these were clad in the military costume of their times.

The able artists who executed the statues of St. Peter and St. Paul now occupying (very incongruously, it is true,) the summits of these columns, had this difficulty to contend with, that their statues were, of necessity, enveloped in drapery; the talent with which the difficulty has been met is evident, and viewed at any reasonable distance, the statues look well. The drapery is arranged so as to be narrowest at the ancles, and the small perforation which it has been possible to take advantage of between the feet, has not been neglected, whilst the narrowing of the upper portion of the pedestals has greatly aided the grace of the general contour. It seems to me apparent that bronze is the only material which can enable the sculptor to make a statue fit in every respect for such a position; besides, to raise a monumental statue of so mean a material as that proposed, is altogether indefensible, placed on a magnificent column it becomes absurd; reason and good taste require, and the universal practice of the best periods of art point out, that statues in the position of that contemplated, should be of a more costly material than the pillar, which can only be considered its pedestal. The same reasoning by no means applies to the lions or sculptured portions of the column, as witness such ancient monuments as we are acquainted with, where the sculpture is merely intended as appropriate architectural decoration. In the Parthenon, the exterior sculptures were of marble; they only served to mark distinctly the character of the temple, the statue of the Deity within. The object, so to express myself, of the erection, was of far more costly material. The columns at Rome were decorated with appropriate and historic sculptures marking their character; the statues of the Emperors, the objects of the monuments, were of bronze.

I have some doubts whether the bronze columns which the French have erected are in good taste; they are imitations, or are designed on the principles of structures erected in marble. On the contrary, it has ever appeared to me that Bernini has displayed more philosophy and taste in his famous Baldachino in St. Peters, in having erected, as he has done, a light and peculiar structure, in which he has taken every advantage of the capabilities of his material.

When we look around us and see, I had almost said in every important city in Europe, monuments of the most magnificent description erected, it is with a feeling of mortification that we contemplate a proposed departure from propriety and good taste in our great and wealthy metropolis. I hope that an effort may yet be made to amend the resolution as to the statue. Should you think these few general observations worthy of a place in your excellent journal, you will gratify,

Sir,
Your very obedient servant,
C. H. W.

Edinburgh,
Sept., 1840.

CONSUMPTION OF SMOKE.

Sir—The possibility of ridding a large manufacturing town of the smoke which rises in such dense volumes from the long chimnies has always been a desideratum; but the methods employed to effect this have been so expensive or complicated, involving loss of power or extra labour, that they have been but little used, and the nuisance with all its disagreeable effects continues unabated.

Mr. Hall of this town has just patented an invention, simple, cheap, and effectual. I have this day witnessed its effects, and was much pleased with its simplicity, and astonished by the effective consumption of the smoke.

The principle of the invention, that smoke passed over a bright fire is consumed, has long been known; Mr. Hall only claims the adaptation of the principle which is thus effected:—

The fire place is divided lengthwise, by a thin wall of fire bricks, so that there is as it were two fire places under the boiler, each of which communicates with the main flue or chimney by a separate flue, therefore the two fire places would have no connexion were it not than an aperture is left at the top of the partition wall, near the front of the fire-places, by which means the two fires can communicate with each other, so that were the flue at the end of one fire closed, and the other open, the only passage for the hot air and smoke of the fire, whose direct communication with the chimney is cut off, would be through the aperture at the top of the partition wall, and over the other fire whose direct communication with the chimney is still open. It will be seen that by means of this arrangement the principle is easily applied. The fire, whose direct communication with the chimney is closed, being charged with fresh fuel, its smoke, in its route to the chimney, must pass through the aperture of the partition and over the other fire, which, being bright, effectually consumes it. By the time the fire last charged has burnt bright, the other will require replenishing, its communication with the chimney is therefore closed and the other opened, the low fire is charged, its smoke passes over and is consumed by the other bright fire. Thus by alternately charging one fire and then the other, all the smoke is consumed. The machinery for alternately closing the dampers is exceedingly simple. The smoke being all consumed a saving of fuel is obtained.

Whether the manufacturers will avail themselves of this invention, and thus materially improve the town, is uncertain; it is to be hoped they will; they ought at least to investigate the matter. One of Mr. Hall's furnaces is generally at work in Messrs. Brigg and Sons' mill in Carlton-street, where its operation and effects may be seen. The inhabitants of Leeds should not let this opportunity pass without making an effort to abate this nuisance.

Your's respectfully,
C. L. Dresser.

Commercial-buildings, Leeds, Sept. 16th, 1840.

COMMENTS ON PORTICOES.

Sir—When in his 'Remarks on Porticoes,' page 295, speaking of those which project across the pavement for foot passengers, A. W. H. says: "the beautiful portico of Hanover Chapel, in Regent-street, and those of the Haymarket Theatre, and Melbourne House, Whitehall, favourably illustrate this position," are we to imagine that he at all regards with a favourable eye, or intends to express himself in favour of, Nash's portico to the theatre abovementioned? If he does not, he has expressed himself most incautiously; and if he does, I for one certainly do not envy his taste, nor covet his compliments, since in my opinion that portico, in whatever direction it may be viewed, is a most vile and trashy piece of design. Its poor miserable and starved looking cornice—as meagre and shrivelled as that of the United Clubhouse,—would alone suffice to damn both the design and the designer.

If your readers are not so ultra-genteel as to shudder at those horrible vulgar things called proverbs, I would remind them of that which says "Fine words butter no parsnips," as being quite à propos to the occasion, for though that miserable affair in the Haymarket, is called Corinthian, its more proper title would be the Cockneyfied Order. With regard to the inner or back elevation, it would disgrace a modern Ginshop. I know not what A. W. H.'s ideas may be of a portico "gracefully breaking," the line of houses by projecting into the street; but I do know that seen in profile the Haymarket portico, presents a most ungraceful gap, looking as if a column had been there knocked out *pro bono publico*, so as to leave room enough for a half-a-dozen fat old ladies to walk through arm in arm.

As A. W. H. has condescended to mention St. George's, Hanover Square, —which is so little spoken of as a piece of architecture that we might fancy it to be some most obscure and insignificant church, not included within the 'bills of gentility,'—it is strange he should not have quoted that one as the very best instance of all where the footway is carried through the portico. A portico projecting over the foot pavement is it seems just about to be erected in front of the Adelphi Theatre; but it may with tolerable safety be predicted beforehand, that it will not be particularly ornamental to the street, since unless extended in front of the adjoining house on each side, it cannot be much bigger than an apple stall, and will perhaps look not much unlike an unglazed shop front, dragged forward before its neighbours.

C. C.

THE ARCHITECTURE OF LIVERPOOL.

By a Stranger.

In the following remarks, let it not be supposed that the writer is governed by prejudice or partiality, or "set down aught in extenuation or malice." He scarcely knows an individual in the town, and his visit has been but to add a little more to his stock of architectural knowledge, which, with a student's patience and perseverance, he has spent days in travelling and many nights in study, during nearly half his life, to obtain.

And first to the Custom-house. This edifice, uniting within itself the Post-office, and one or two other departments beside, is considerably larger, more imposing and magnificent, than its namesake in the metropolis, and yet there are many things deteriorating from its otherwise grandeur of appearance, and most painful to the practised eye of taste or travel. The principal front facing Castle Street consists of a quadrangle, the centre composed of a massive prostylar[*] octostylar[†] portico, the columns being copied from those of the little Ionic Temple of Ilissus, situated upon the banks of the *river* of that name in Greece. This portico is simple, grand, and expressive, and its large and chaste proportions beautifully adapted to its purposes. The proportions of the rest of the building are upon the same scale of plainness, simplicity, and largeness, I had almost said ponderosity of proportion, suitable to the extent and commercial nature of the building, where not elegance, but the substantiality and solidity commensurate to its objects are required. The plain portions of the buildings are adorned by pilasters, but the highly ornamental base, both of columns and pilasters, should never have been permitted to continue their corrugated torri[‡] round the edifice, thus disproportionately mixing richness and plainness upon the same face. The wings are simple and unexceptionable, and the bold, handsome stylobate[§] gives both dignity and elevation. But, upon carrying the eye upwards, it is most painfully offended by the unsightly dome and tambour upon which it rests. This excrescence is most truly unfortunate; *firstly*, the Greek character of the architecture did not require a dome, a thing utterly unknown to the Greeks themselves; and, secondly, the contour of the thing itself is both ugly and inharmonious. Had the architect, when he had resolved upon a dome at all, consulted the graceful simplicity, swelling circumference, and tapering outline of that of St. Paul's, London, his conceptions might have been more chaste, and his work less open to criticism. The circular heads to the windows are equally architectural anachronisms. The sides facing the Dock and Hanover Street, are adorned by a similar portico to that last described, and placed upon a bold flight of steps. Here the critic can only praise the pilasters, intercolumniations, entablature, cornice, windows, and doors; the latter, especially, are bold, handsome specimens. The rear elevation is most infamously miserable. The eye is pained and disappointed at the wretched poverty of ornament and detail; entablatures discontinued; two tiers of windows in one part, and three tiers in another, the upper one being beggarly loopholes in the place where the entablature should have been. The interior has also faults of no mean order; besides want of taste, the mixtures of styles, the commonplace, unimaginative nature of the details, it wants light. Still, upon the whole, in spite of many serious defects, this edifice, from its size, grandeur, chastened simplicity, isolation of position, and importance as to utility, is well worthy of admiration from the stranger, and respect from the citizens of the good town of Liverpool.

---

[*] Projecting.
[†] Eight columned.
[‡] Circular portions of the base.
[§] Plinth or base, on which the building seems to rest.

Let me now turn to the Royal Bank, Dale Street, *i. e.* from the extreme of simplicity to that of richness and luxuriance. This edifice is just completed, and is composed of a basement of enormous height, upon which is placed a Corinthian order containing two tiers of windows. The centre is composed of seven-eighths columns. There is much richness and originality in this edifice, and although its gorgeousness and profusion of complicated carvings, mouldings, and details may please vulgar taste, it is too sadly overdone to please the more practised eyes of the architect or amateur. The basement is ridiculously high; the Venetian windows too redundant of carving and various ornaments; the cornices would not be too rich upon a plainer face, but now, cut dentil, carved ovolo, and running beads weary the eye, which, like the dove of old, finds no resting-place to fix upon, but, wearied and fatigued, it turns away, but is reluctantly compelled to own the extravagant richness and luxuriance of ornament. And yet, whilst some parts are more adorned than any building in the country, the central windows are mere loopholes, not having even an architrave round them, whilst the rest of the windows have not merely rich architraves, but revel amid a profusion of carved foliations. The top is surmounted by a balustrade, which, with the plinth, is ridiculously high. I would also call attention to the wretched life-size sculpturing of the arms in the centre of the building, which bears a distant resemblance to an amatory lion making love to some sportive unicorn, who, rejecting his addresses, and tossing up his head with its tremendous horn, seems to repeat to himself the scriptural piece of self-satisfaction, "My horn shall be exalted." Upon entering the interior, the eye is dazzled by the rich profusion of architraves, friezes, cornices, ceilings, panels, and ornaments; the eye is wearied and confused, and attention exhausted; no repose, no chasteness, all is the most lavish profusion. The grand error seems to have been to have crammed as much ornament and expense as possible within a given surface.

I will now turn to the Town-hall and Exchange. It is much to be regretted that the former does not face directly down Castle Street, instead of the portico approaching one side of the street considerably more than the other. This edifice is highly creditable for the day in which it was executed; and, although there are no great beauties, there is little actually to condemn beyond the meagre, wretched carvings between the capitals of the columns. The assembly-rooms are admirably proportioned, more especially the great room, which is in sesquilateral proportion, but the ornaments are somewhat few in number, and poor in detail. To the staircase, a later work, by Sir Jeffry Wyatville, must be afforded the most unqualified approbation. Its proportions, decorations, colour, and all other adjuncts, are beyond all praise. Its effect is that of the most chaste repose; and, of its size, there are few finer in the kingdom. Returning to the "place" forming the quadrangle of the Exchange, the stranger is much struck with the similarity of this, upon a small scale, with certain edifices upon the Continent. The effect of this square from one corner, with the Nelson monument in the centre, is particularly fine; for, although there is nothing worthy of note in the architecture itself, still there is an importance highly pleasing and effective. The monument is worthy of attention; the lost arm of this great hero is here ingeniously hidden by a flag. The base, which is circular, is ornamented by basso relievos and statues, full size, chained to the base, and resting upon a step, which gives a pleasing breadth to the lower portions. This adds much to the effect of the base; but whether it is worthy of the better feelings of humanity to commemorate our triumphs by figures in chains and painful postures, thus perpetuating the fierce passions of war, now that peaceful times are emptying their cornucopias around us, I leave to more philosophic critics.

EDER.

An enormous organ is now in the course of erection in the Abbey of St. Denis. It contains about 6,000 pipes, amongst which are some measuring 52 feet, and weighing 12,000 lb. This magnificent instrument is nearly completed.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

TENTH MEETING.—*September*, 1840.

(From the Athenæum.)

SECTION G.—MECHANICAL SCIENCE.

President.—SIR JOHN ROBISON.

Vice-Presidents.—His Grace the DUKE OF ARGYLE: Rev. Dr. ROBINSON (Armagh); Messrs. J. TAYLOR; J. WALKER.

Secretaries.—Messrs. J. S. RUSSELL; C. VIGNOLES; J. THOMSON; J. TOD.

Committee.—Messrs. J. Dun, T. Edington, W. Fairbairn, J. Glynn, Professor Gordon, Messrs. R. Griffiths, I. Hawkins, E. Hodgkinson, W. Jessop, A. Liddell, J. Macneil, R. Napier, Sir J. Rennie, Messrs. J. Roberts, J. Smith, C. W. Williams.

THE first paper read was "*On Safety-valves for Steam Boilers,*" By Mr. Galline.

The merit of the proposed alteration rested on the general principle, that the safety valves at present in use are not large enough; and Mr. Galline's object was to allow a large surface, like the lid of a chest. to rise when the pressure becomes sufficient to force it up; so that, on an accumulation of steam, it might escape, before any accident could take place. His proposal was, in brief, that a large valve shall open instead of a small one.

"*On extinguishing Fire in Steam Vessels.*" By Mr. Wallace.

Mr. Wallace proposes to effect this by steam itself. The plan has been some time before the public, and many successful experiments made in the presence of scientific persons. Among the most important was the following, made on board the *Leven* steam-boat:—On the cabin floor, a space of 10 feet by 14 was covered with wet sand, on which was laid iron plates and on these a fire was kindled with about 4½ cwt. of very combustible materials, such as tar barrels, &c. A hose 34 feet long, 2½ inches in diameter, extended from the boiler of the engine to the cabin, and when the fire had been sufficiently kindled, so that the panes of glass in the windows of the cabin began to crack by the heat, the steam was let in, and the door of the cabin shut. The fire was extinguished in about four minutes. Several trials were made, and all with like success. On another trial, a metal pipe of a greater diameter than the hose was connected with the steam-boiler, and extended into the cabin. A small square hatch was cut in the deck immediately above the cabin, and through this opening were lowered down into the cabin two moveable grates, each containing a blazing fire, well kindled, of about 1 cwt. of coals. The hatch on the deck and cabin doors were then shut, and the steam let in, and in 15 minutes the small hatch was opened, and one of the grates hoisted up, when the whole mass of coal and cinders, which had before formed a powerful fire, were found to be completely extinguished. This experiment was repeated twice with equal success.

In reply to a question from the President, Mr. Wallace said, that the hose might be made either or silk or canvas painted. It was stated that in Philadelphia, and now in London, the firemen always direct the water to the lowest part of the fire, that it might be converted into steam. Dr. Hamel, of St. Petersburgh, mentioned, that in Russia they have used woven hemp hose for fire-engines more than forty years. Mr. Roberts, of Manchester, said, that in that town there had been a fire in a factory some time since, when the men went in, broke the steam-pipes, which were charged, shut the doors, and the fire was out immediately.

"*On Wheels of Locomotive Engines.*" By Mr. Grime.

The rim or felloe of the wheel is turned, welded, and blocked in the usual way to the size required, say three feet diameter; the side, or front rim of the wheel, is formed out of boiler plate-iron, say ⅜ of an inch thick, clipped round to size required. I then, said the writer, take the plates and punch out the centre, which forms the eye of the wheel. After this the shapes are punched out, leaving the boss and arms standing together, with a sufficient breadth of iron at the extremity of the arms that will be equal to thickness of felloe, say 1½ inch to 2 inches, for wear, and, when welded, forms part of the felloe. The boss of the wheel is punched out of plate-iron, say ¼ of an inch thick, into what I denominate washers; I then pile them one upon another, to the breadth of the wheel, taking notice to cross the grain of iron every washer when piling them. By so doing, the boss, or nave, will be considerably stronger and tougher than if the grain of iron went all one way. When this is done, it bears the name of "faggotted iron." The washers being piled to the required thickness, I pin them to one of the punched plates, the diameter of wheel required; then put the rim or felloe on, and pin it to the plate. This being done, I put in the midfeather, say ½ inch thick, and the depth of felloe and piled plates or boss, there being in every washer a half circle punched out to receive the midfeather; the other plate is then put on, and pinned to the other parts. The wheel being now formed, it is taken to the furnace, which is constructed with a revolving table at the bottom, so arranged that it can be dropped or raised. This table is formed of fire-brick, and on the top are placed five loose bricks, to keep the wheel from touching the table, and to enable the workmen to get the wheel into the furnace and out again by means of a fork. The furnace having been got up to an intense heat, the table is set to a particular mark, the door of the furnace is raised, and the wheel slided on to the table; the door is then closed, and the table, which is workéd from underneath by a tooth and pinion, is turned round, presenting every part of the wheel regularly to the flame, as the flame rushes through the furnace. The wheel, having been in about three-quarters of an hour, and having arrived at a perfect welding heat, the table is turned to the mark before mentioned, and the wheel is slided out on to an anvil. This anvil is planed perfectly true on the face, and is larger in diameter than the wheel. Above the anvil is the hammer, of about 15 cwt., suspended at a height of about 12 feet, the face of this hammer being planed perfectly true, to correspond with the face of the anvil. As soon as the wheel is placed on the anvil, the hammer is released, falls on the wheel, and perfectly welds it into one entire solid at a single blow. Before pinning the wheel together, I put the various parts into a solution of vitriol and water, and, should there be any part corroded, it immediately removes it, so that there is nothing but pure iron, and a good welding is easily obtained. The wheel, when cold, is turned up in the usual way.

"*On Warming and Ventilating Buildings.*" By Mr. Ritchie.

The principal object of this paper was to call the attention of architects to the construction of houses, with a view to a better provision for heating and ventilation. The author described the method adopted by Sir J. Robison, whose house is warmed by a large supply of air heated to 70°, which is allowed to issue directly into the lobby and staircase, which it heats to 60° even in the coldest weather. This heated air is allowed to enter the sitting rooms freely by concealed apertures over the doors, and the vitiated air is carried off through openings in the ceilings by separate flues in each room.

Mr. Hawkins always found that, in the sitting rooms, open fires were required to warm the feet, though not necessary in bed-rooms.—Mr. Hartop agreed, and considered Sylvester's Radiating Stove the best for the purpose, in addition to the general heating apparatus.—Mr. Vignoles concurred, and stated that nothing prevented Sylvester's stoves being universally introduced, but their high price.—Mr. Hawkins stated, that, from experience, a large fire with a small supply of air, was the most economical mode of using fuel.—Sir John Robison stated that, with the apparatus in his house, he can keep his staircase at a temperature of from 58° to 62°, when the current of heated air was only 64° as it issued from the apparatus, and that the additional expense caused by his provision for ventilation did not exceed 20*l.*

"*On the Temperature of most effective condensation in Steam Vessels.*' By Mr. J. Scott Russell.

Much (said Mr. Russell) has been said regarding the perfection of the vacuum formed in the condenser of a steam-engine, especially a marine engine. It does not appear to be known, that a vacuum may be TOO GOOD. We hear it boasted every day, by rival engineers, that their engines have the best vacuum. Some boast their vacuum at 27 inches, others at 28, others at 29, some at 30, and at last an engineer appears who boasts a vacuum of 30½ inches! It is to be regretted that time and talent should be thus wasted. It is a fact of great importance, and it is the result of theory, established on incontrovertible truth, and confirmed by experiment and by practice, that a vacuum may be too good, and become a loss instead of a gain. The truth is simply this, and should be known to every engineer: *If the barometer stand at 29½ inches, the standard of this country, the vacuum in the condenser is* TOO GOOD *if it raise in the barometer more than* 28 *inches of mercury.* This important truth is incontrovertible—it is practically exhibited every day. The following is a simple proof of this doctrine, divested, as far as possible, of a technical form, and put in the shape of an inquiry into the best state of a condenser:—

Let l = the caloric of water of 1°.
c = the constituent caloric of water in the state of steam.
e = the total force of steam in the boiler, in inches of mercury; and
x = the elastic force of steam at the temperature of best condensation, which we seek to discover.

Then from the law which connects the elastic force of steam with temperature, it follows, that in case of maximum effect, or the temperature of best condensation,—

$$\frac{l}{c}=\frac{x}{e}, \text{ that is, } x=\frac{e\,l}{c}$$

Now c is 1000; and if the steam in the boiler be at 5 lb. above the atmosphere, or if $e=40$ inches of mercury, and $l=1$,

$$x-\frac{40}{1000}=0{\cdot}04$$

Again, if the steam be at 7½ lb. = 45 inches,

$$x=\frac{45}{1000}=0{\cdot}045$$

Again, if the steam be at 10 lb. = 50 inches,

$$x=\frac{50}{1000}=0{\cdot}05$$

Hence we find, that the best elasticity or temperature in the condenser depends on the elastic force of the steam in the boiler.

With steam of 5 lb. in the boiler, the elasticity of maximum effect in the condenser is 93° Fah., and the best vacuum on the barometer is 28.

With steam of 7½ lb. in the boiler, the elasticity of maximum effect in the condenser is 95°, and the best vacuum on the barometer is 27·8.

With steam of 10 lb. in the boiler, the elasticity maximum effect in the condenser is 97°, and the best vacuum on the barometer is 27·6.

In like manner it would be found, that with steam of 50 lb. in the boiler, worked expansively, as in Cornwall, the best vacuum in the condenser would be about 26. on the barometer.

It is hoped, therefore, that engineers will not in future distress themselves at finding the vacuum of their condenser much less perfect than the vacuum of others who have obtained 30 and 30½ inches at so great loss of fuel and power. To obtain a vacuum of 29½, with the weather glass at 29·75, and steam at 7½ lb., would be to sacrifice four horses' power out of every hundred. In a day when the barometer is as low as 28½ inches, the vacuum in the condenser would indicate 26·8. In speaking of the vacuum in the condenser, it would save much ambiguity to indicate the elasticity merely of the steam in the condenser; thus, if the barometer stand without at 29½, and the barometer of the condenser at 28, it might be stated that the steam in the condenser stands at 1½, being the point of maximum effort. The indication would convey at all times more precise information.

Mr. Russel stated that the President had just put into his hands a communication in French on this subject from Mr. Barnes. Instead of a jet playing inside the condenser, M. Barnes allows it to rush in suddenly, and then stops it by a slide valve.—Mr. Fairbairn wished to know whether the facts stated by Mr. Russell had been practically established.—Mr. Russell stated how the experiment might be made.—Mr. Fairbairn considered this a very important subject, as bearing on the economy of fuel, and regretted that Mr. Russell had not given an account of his experiments.—Mr. Russell suggested that Mr. Fairbairn should himself undertake the experiments.—Mr. Hodgkinson considered it very important that experiments should be carried on; and Mr. Fairbairn, that experiments should be made on steam at all pressures. It was suggested that this was a proper subject to be inquired into by the British Association, and it was agreed that the Committee of the Section should discuss the propriety of applying for a grant to pursue the experiments.—Mr. Taylor stated that they use plungers in the air-pumps in North Wales; and Mr. Hartop, that in America air-pump buckets have been made without packing, and found to answer well.—Mr. Roberts stated that he had made engines with solid pistons without packing, both cylinder and air-pump.—Mr. Vignoles mentioned that such solid pistons had been used on some of the first locomotive engines on the Dublin and Kingstown Railway.

"*On Timber Bridges of a large size, in special reference to Railways.*" By Mr. Vignoles.

Mr. Vignoles commenced his remarks by stating, that he had, by permission of the committee, selected this subject for illustration and discussion before the Mechanical Section, from the notes of a work he was preparing for publication, 'On the General Principles and Economy of Railways,' his object in so doing being to elicit the opinions of his brother engineers, and to invite discussion and obtain information, but especially to direct the attention of all parties interested in the extension of the railway system to a principle of construction which, in many cases, would be found of great advantage in the economy and facility presented for overcoming obstacles, otherwise insurmountable, within reasonable limits of expense. Mr. Vignoles took a rapid view of the history of timber bridges, tracing their first erection in Germany, then through the United States of America, and back to Great Britain. He also described the difference between the principles of large bridges constructed with baulks and half-baulks, and of timber arches, formed of layers of plank laid over each other, and fastened securely together, and, with felt or other means, to make the joints and beds wholly impervious to water. Mr. Vignoles stated, that the first bridge on this principle in Great Britain had been erected at some place in Scotland, by an ingenious mechanic of that country, whose name he regretted not to be able to state. This was many years since. The principle had been also made known, particularly, of late years, by the timber viaducts erected under the direction of Messrs. Green and Son, of Newcastle-on-Tyne, who had been built several, and had designed more; and Mr. Vignoles further explained, that Mr. Nicholas Wood, of Killingworth, who at this time erecting, for the Duke of Buccleugh, a timber viaduct, of great height, and with large openings. Mr. Vignoles disclaimed any intention of discussing the question as to whom the merit of orginality belonged, and observed, that he, at present, purposely refrained from any details, as these had been entered into by Mr. Green both at Newcastle and at Birmingham, reserving any remarks on such details for a future occasion, should it present itself. Mr. Vignoles then explained the peculiar applicability of timber bridges or viaducts to the passage of deep ravines, so often met with in hilly and mountainous districts, illustrating his remarks by diagrams. The communications, for example, to be made between the north of England and Scotland would probably have to be sought along some of the valleys leading to the passes through the Cumberland Hills, and here, as in many similar districts, engineers in the habit of considering such lines well knew, that many miles of favourable country for roads or railways were often to be obtained along the sides of such principal valleys, until some unavoidable appalling obstacle appeared in the passage across some of the lateral openings or ravines. Instances had and might occur where the whole of such a line, otherwise highly desirable, would have to be abandoned, unless some economical construction were devised to surmount the difficulty: and here the timber viaduct would most advantageously be introduced, since many feet additional height in the level of the railway would add but little to the expense. He then instanced several places of formidable height, and of various breadths, where he had already designed, or knew of the applicability of such constructions. In reference to the expense, he stated, that it was chiefly when extraordinary height and either one arch of great span were required, or where a series of arches, of large openings, were wanted or cou be introduced, that the timber viaducts were the most economical. In ordinary heights of 50 or 60 feet, and with arches of less span than 100 feet, and particularly in countries presenting facilities for construction of stone, these latter would be undoubtedly preferable; but when the height of the construction became great, the great expense for the centering for arches of masonry, and the multiplication of the number of piers, in order to keep the span of the arches to a moderate size, greatly increased the expense, and threw the balance vastly in favour of the timber. Mr. Vignoles instanced the Ribble Viaduct on the North Union Railway (a model and description of which is in the Model Room of the Association), which was about 50 feet high, with five large arches, of 120 feet span, and had cost 60*l.* per lineal foot; whereas, in another place, a timber viaduct, of 140 feet high in the centre, and averaging 100 feet high, with arches of 130 feet span, and extending for a length of nearly 2000 feet, was proposed, which would not exceed in price 20*l.* per lineal foot, the breadth of roadway being, in both cases, 28 feet for a double line of rails. Mr. Vignoles stated, that in extending lines of railways through the west of England to the packet stations, through the mountains of Wales for a communication between London and Dublin, and through many parts of Ireland, along the lines laid out by him for the Government Railway Commissioners, the timber viaducts would, from their cheapness, enable the works to be entered upon, which the great cost of stone would quite forbid; and he concluded by calling on his fellow engineers to turn their attention to this while laying out new lines, and to take bolder steps across the valleys, relying on the timber viaducts to accomplish their objects.

Mr. Blyth thought that Mr. Vignoles had over-estimated the expense of stone, which Mr. Blyth knew had been executed at about 25*l.* per foot.—Mr. Vignoles replied, that it was seldom that stone could be had at so small an expense; when the span is large, and the height great, it is much more costly.—Mr. Smith, of Deanston, agreed with Mr. Vignoles, but did not think that planking was the best method, as it would not stand so long. A wooden bridge should be so constructed, that any decayed part could be taken out and replaced.

THE THAMES EMBANKMENT.

The Select Committee appointed to consider the Petition of the Corporation of London relative to the Embankment of the River Thames, and to report their observations and opinions thereupon to the House, together with the best means of carrying the same into effect; and to whom several Petitions relative to the measure, and Reports of former Committees, were severally referred;—have considered the matters to them referred, and have agreed to the following Report:

The Committee have met and proceeded to examine a Plan and Estimates of the proposed Embankment, submitted by Mr. Walker and Mr. Higgins, and other witnesses: that several petitions for and against the measure having been referred to the Committee by the House, and many other witnesses both for and against the intended plan being proposed to be examined, the Committee are obliged, by the near approach of the prorogation of Parliament, to conclude the inquiry without the examination of many plans for the embankment of the river, or the consideration of any plan for the improvement of the navigation, without any alteration of the present line of embankment. Upon the general subject, therefore, of the improvement of the navigation, with or without any embankment, they give no opinion in the present state of the inquiry.

29 *July* 1840.

Abridgement of the Evidence.

James Walker, Esq., was examined and stated that he has been professionally acquainted with the river Thames, in reference to the subjects of inquiry, for the last 30 years he has been employed, either as assistant or principal engineer, at the greater part of the docks that have been constructed in the part of London. In 1816 he constructed Vauxhall Bridge, and in 1821 his attention was called directly to the effects that the then proposed removal of London Bridge would have on the river Thames. He has been almost constantly employed on works of a similar nature on the Thames from that time to the present day. He was called in by the committee for letting the Bridge-house estates in 1821, along with his friend Mr. Leach, to report on the effect that the removal of London Bridge would have on the water of the river Thames. He did not think that ballasting has done much good; it is done for the purpose of obtaining ballast, and it is only where the ballast is good that the dredging engines have got to work; that has not much regard to the interests of the navigation. It does nothing to take away the shoals. At present the water ebbs so low in the river, above bridge, that in some parts of it, where the width is very great, the shoals are perfectly dry for the greater part of the width across the river; mostly in that part of the river above Waterloo Bridge and the neighbourhood; between Westminster and Waterloo Bridges and below. The dredging vessel above bridge is used chiefly for obtaining gravel for roads, not for ballasting ships and similar purposes. The effect of the removal of London Bridge operating in the way he has stated, increased the velocity of the current through Blackfriars Bridge, and had nearly undermined the piers; so that by going down, which he did in a diving helmet, he could put his leg under the caissoon bottoms, under the platform on which the bridge stands; the consequence was that the city, partly through that cause, and partly through the decayed condition of the stone, ordered a survey to be made, and an estimate; and since that time, five of the piers have had coffer-dams put round them, and the foundations extended down to about 14 feet below the old bottom, as regards Westminster Bridge, although a great deal of trouble had been taken for a great many years in supporting it, the Commissioners of Westminster Bridge, also for the same reason, have commenced strengthening the piers in the same way as has been done at Blackfriars Bridge, by coffer-dams; he considers that both of them are the effect of the removal of London Bridge. He did not think that any increase of ballasting would prevent the accumulation and increase of shoals, because while the river is so unequal in width as it is now, you may keep ballasting, but the velocity being slow at the wide parts, you will have a settlement always taking place there again, and then you must go on constantly with the ballasting. The first thing to be done is to regulate the width of the river. The plan of the river which is before you will show you, that in places now between London Bridge and Vauxhall Bridge the river is double the width that it is at other places. The effects by London Bridge being removed since 1821, are what he has before described, to deepen narrow places very much, and to cause large shoals in the places where the river is so very wide. To give the Committee an idea what the present width is, he stated, that the width now opposite the Penitentiary is 600 feet at high water; opposite Millbank, to the Bishop's-walk, it is 1,050; opposite the Board of Control it is 1,200; and opposite Buckingham-terrace it is 1,480. Then it keeps narrowing by degrees, until below Southwark Bridge it is 720, and at London Bridge the waterway is 690. While the river is so unequal as that no dredging would do much good. If you dredged so as to get proper depths for navigation in the wide parts, you have a settlement of mud, and a constant removal of that again, or an accumulation of shingle to fill up those cavities. The idea here was, first to endeavour to get something like a regular section, not strictly increasing in width by degrees, but approaching to it as far as could be done consistently with the value of the property on the sides of the river. The waterway of Vauxhall Bridge itself is 702 feet; the width of the river 200 or 300 yards above is 680 feet at high water, between the wharfs. He does not consider the whole of that waterway useful for the purposes of navigation as a thoroughfare, but it is for the general purposes of trade, that is to say, that the barges can go up to the wharf-side, and can go away again at high water at all times. There was an apprehension that the present embankments that have been carried out, such as that one at the House of Commons and others, would have left in the parts of the river near it a considerable quantity of mud, and the proprietors of property above bridge had a clause introduced into the Act for building the Houses of Parliament, keeping open their claim for compensation in case of damage being done. He has, from time to time, as employed by the Commissioners of Crown Lands, sections taken of the states of the ground at different times, and the fears of those parties have proved to be very much over rated; the increase is not so great as he expected. The increase is very variable; perhaps in some places it is lower, and in other places higher, but as a general position he does not think there is much increase. There are now deposits in consequence of the embankments. The coffer-dam around two of the piers of Westminster Bridge tended to send the water over to the opposite side, and to cause a settlement of mud on the Middlesex side: that coffer-dam is now removed, and the opening which was closed by the coffer-dam is deeper and better than ever it was. The deposits have been between high and low-water mark. The effect, opposite the projection itself, is to decrease the deposits by narrowing them; but the effect also is to cause the settlement of mud above and below. The effect that would otherwise be produced is much lessened by the constant passage of steam-packets up and down the river. The mud is kept in a state of suspension instead of being deposited. What the embankment would have tended to have done has been prevented or removed by the wash of the steam-packets. The removal of the coffer-dam from the western arch of Westminster Bridge will tend to remove the deposit that has taken place in the course of last year: and when the coffer-dam in front of the new Houses is removed (which it will be when the Houses of Parliament are finished), with the large quantity of ground which he had put out for the purpose of securing the coffer-dam, that will tend to bring the current over to the Middlesex side. He hopes the effect of continuing the embankment will be, if properly done, to remove the shoals. The idea would be, whether by embankment or otherwise, to deepen the river by the removal of the shoals, and to apply those shoals to filling up behind the embankment. He contemplates two operations, both deepening the river artificially and building the embankment; the embankment could not be made without the material which will be taken from the bed of it to fill in behind the embankment, which will have the effect of deepening the river. Deepening the river, the supply of water remaining the same, will tend to throw a greater quantity of water within a certain part of the channel, but it will not be at the expense of that side of the river where there is no embankment; the embankment being to be formed close up to low-water mark on the north side. There will be more water on the south side than there was before.

Mr. Walker explained that it is not only the land floods coming down, that chiefly forms the current of water in the river Thames opposite Lambeth; but it is also owing very much, except in extreme floods, to the tides. Now, whether it be from tidal water, or from land floods, the effect of narrowing the river on the north side would be, as there is a given quantity of water to come down during the land floods, to press that water more over to the south side, and to increase the velocity. With land floods the quantity is given; that is to say, it is fixed, whether the opening be large or small. With regard to tidal water, it depends on the space to receive the tidal water; but the effect in any way would be to give greater velocity, and tend to the removal of mud from the shoals on the south side. Where the river is very wide and straight, there is a very considerable quantity of mud, three, four, or five feet and more; at other places, at Waterloo Bridge, for instance, although the width is very great, there is not so great a quantity of mud, because the flood-tide rather takes that off. Mr. Walker stated that his evidence given referred to one side of the Thames only. The ultimate scheme is to embank both. It may be done with one side only, but not so complete as with both sides. Although he uses the word embanking, the Committee must not understand that there is an intention, or that it is practicable to embank both sides of the river by walls from side to side, but that every respect must be paid to the way in which the present premises are occupied, still improving the navigation, and the value of the property. There is a large space occupied now by coal barges, some on the opposite side by barges with timber. There may be places where, by carrying out the embankment wall, the trade may be so much interfered with as to damage the property, unless provision be made in the proposed improvements for accommodating those barges. He proposes to place the barges alongside the wharfs, and extended a great way out, and to lie on their beds as they do now; but still the river, as regards the navigation, and as regards the health of the town, and he thinks as regards the property itself, improved. The area of the river would be diminished where it is too wide.

The effect of the removal of London Bridge on the sewerage has been to expose a larger surface of the bank of the river at low water, and to render, therefore, the injurious or unpleasant effect from a discharge of the sewers greater than before. The effect on the bottom of the river generally has been to deepen it in certain places, and to render it shoal in other places very much, as he ascertained, and as he read from the report of 1821. He thinks it is quite impossible to look at the river Thames, at low water now, without seeing, as regards the trade up the river, and the navigation opposite to London itself, that the river is in a state that wants improvement very much; and this is to be taken along with it, that as the effect of all those floods is constantly to deepen in one place, and to shoal in others, that that deepening will extend in time, so as to be injurious to the property on the banks of the river, as regards its foundations. He thinks the river will undergo further change. The effect of the dam at London Bridge was to keep the bottom, above London Bridge, very much higher than below London Bridge; the dam is now removed, and there is, as was predicted by Mr. Smeaton, a constant movement of the bottom of the river downwards, and an increase in the depth in certain places; and that will go on for many years to come, perhaps generations. The effect on the water-side property, if continued without some protection, may be, as he has already said, to endanger the foundations of some of the best buildings on the river Thames: I refer to the great current in one place, and to the forming pools in the middle of the river, which tends to draw the sand from under the buildings on the banks of the river. It would be desirable, in his opinion, that the bed of the river should be made uniform, or nearly so, in point of depth, and gradually increase in width from Vauxhall Bridge downwards.

The calculation which has been made for forming the embankment has been, in the front of the private houses, where the embankment is to be made, built of brick and filled behind with the excavations from the bed of the river; the Government property in the neighbourhood of Whitehall, and also Somerset House, has been estimated to be faced with stone. He has no hesitation in saying that this embankment would improve the navigation throughout; there is no way, he contemplates, in which any person could say otherwise, excepting this, that where the embankments are made there is a small decrease of tidal water, somewhat less of tidal water comes up the river than would before, referring to width only, and therefore a somewhat smaller velocity of the ebbing tide; but that would be partly compensated for by the deepening. He has seen this done under his own directions on the river Yare, and the effect has been good, both as regards the harbour from the removal of the bar, and the improvement of the navigation up to the town; that was done not by embankment wall, but by a dwarf piling, exactly as the section now before the chairman shows it. Extensions into the river Thames are sanctioned, and their extent defined and regulated, by the navigation committee of the city of London. The proposed width varies from 600 to 800 ft. If the conservators of the river think that barges can lie without prejudice to the navigation or highway, they may lie in the river afterwards just as they do now; but if the embankment be carried on, and these recesses left, both as regards the current of the tide, and as regards being injured by other barges, those docks would be snugger than the barges lying out in the river. Injury may be done to the individual by not allowing him to go far enough into the river, or injury may be done to the river by allowing him to go too far, unless a general plan is laid down and acted up to. When one embankment is carried out, or a wharf carried out beyond the other, great inconvenience arises to both of the parties; and it is a constant source of quarrel in the river Thames at this moment; one party opposing the embankment and another supporting it; and he takes it the members of the navigation committee itself are much annoyed by individual applications, they themselves having no certain rule to go by. He proposes that the allinement should be general; it should be either an embankment or a dwarf piling, to regulate the section of the river. He need hardly say that his answers must be very general; but in a great work, such as this, reference would be had to the interests and wishes of the individual parties who have property on the banks of the river, and their wishes complied with, so far as that can be done without prejudice to the great public measure; and if that were done, he thinks benefit would be done to all. These recesses would, in degree, be injurious to the general plan of regulating the velocity of the river, and the less of them the better; but as they would be recesses with their sides at right angles with the line of the river, their effect would be far less injurious than gradual widenings and narrowings. He presumes that the only way the thing could be done practically, is to consider these recesses, as well as the back ground, private property after the works should be complete; he thinks it impossible to introduce any occupier or proprietor between the present bank of the river and the proposed embankment. His idea is, that all the ground reclaimed should be considered as belonging, upon terms to be agreed, to the owner of the adjoining property. He considers that the property on the banks of the river will be improved in value by the alterations; he does not mean to say there may not be some exceptions, but he thinks very few; and it is impossible, in a great work like this, to have good done to all without some injury, perhaps, to individuals. He has estimated for a brick wall, generally; but, in some places, stone; he considers all the answers he has given now to have reference to the north side of the river.

The whole length of the embankment, between Vauxhall and London Bridge, is 11,055 feet, which is exclusive of the part that is not intended to be interfered with. The length he has given terminates at Dowgate Dock; that is the whole length he proposed embanking on this plan. There has since been, he has been informed, applications made by the owners of property below to extend it farther, nearer to London Bridge. Dowgate Dock is about 1,000 feet from London Bridge. The 11,055 feet includes not only the portion he proposes to embank, but also these recesses which he proposes to leave for the accommodation of the trade. The total distance from Vauxhall to London Bridge is 15,900 feet, according to the present line of river frontage; his whole estimate is £310,000; £105,000 of that, as far as he can ascertain, is crown property. He thinks 2*d.* per foot per annum would cover all the expenses of the cost, with moderate additions for contingencies, expenses of management, rent, &c. He considers that the mud so carried away would not be deposited in a still more important part of the river, in the Pool, for instance. There would be a diminished quantity of tidal water, but that would be compensated partly by increased depth, by removing the shoals which now appear above low water, and would be more than compensated by making the bed of the river of a uniform character both in breadth and depth; at present there is a rise at low water from London Bridge up to Westminster Bridge of 2 ft. 5 in., the water being kept up by the shoals in the way described; if the river were regulated and deepened, the effect would be to lower the water at Westminster Bridge, and all the way up the river lower than it is now; therefore in depth there would be a greater quantity of tidal water to ebb and flow, which, he apprehends, in cubic quantity would exceed the contents of the embankments. The width of the river when the embankment is done, with what is its present width at those points, will be as follows:—at the Penitentiary no diminution is proposed to take place in the 600 feet. From Millbank to the east end of Bishop's-walk is intended to be reduced from 1,050 to 800 feet. Opposite the Board of Control it is proposed to reduce it from 1,200 to 840 feet. Opposite Buckingham terrace, from 1,480 to 850 feet. Opposite Somerset House, from 1,250 to 870 feet. Opposite Temple-stairs to Lett's timber-yard, from 1,240 to 870 feet. Opposite Whitefriars-dock to Bull-stairs, from 1,040 to 770 feet. From Trig wharf to the opposite side, from 920 to 730 feet. West side of Queenhithe dock to opposite side, from 700 to 680; after which the diminutions are small, and the river gets narrower.

(To be continued.)

STEAM NAVIGATION.

STEAM NAVIGATION IN FRANCE.

Extracts from the Report of Count Daru to the Chamber of Deputies, in the name of a Special Commission intrusted with the examination of a projected law relative to the establishment of Steam Packets between France and America.

THE form, dimensions, and power of steam-boats evidently depend on the service to which they are destined. They were not long merely employed in the ascent and descent of rivers, but soon the limits of steam navigation were enlarged, increasing the power of the engines from 20 to 80, 160, 200, and 250 horses, it became possible to extend the field of their employment to venture on the sea with them. Towing boats, which had been constructed in a few ports, soon threw a light on the superiority of the new system, by bringing out large vessels, weather bound and condemned to inactivity, and drawing them in their wake with a facility which seemed to defy the elements. From that day the bright days of sail-navigation, which, till then, was looked upon as the *chef d'œuvre* of human understanding, were eclipsed. Now vessels were started on every coast. Regular and rapid communications linked together every important town, such as Havre, London, Dover, Hamburgh, Rotterdam. This was the forerunner of more daring attempts.

In 1819 a vessel from the United States, "the Savannah," had crossed the ocean from Liverpool to New York, partly by wind and partly by steam. America, then, had the lead again in daring to apply Fulton's machine to long voyages, and this is the more remarkable, that it has always had but few steam-boats on sea service. This first essay was not repeated, until, in 1835, when the English undertook the passage from Falmouth to the Cape of Good Hope; the Atalante, provided with an engine nearly similar to that of the Savannah, accomplished in 37 days a distance of 2,400 nautical miles. The Berenice, the Medea, the Zenobia, performed passages of different lengths on the coast of Africa, and in the Indian seas. All these boats were English. In the Mediterranean, steamers of different nations, Neapolitan, Sardinian, Austrian, French, crossed from one port to another. Lastly, our service of steam-packets from Marseilles to Alexandria was established, and threw open to us a new access to the East. The passage to Constantinople, which was sometimes 45 days in duration, was thus reduced to 13½ days.

These numerous experiments gave rise to the idea that, by the aid of steam, it was possible to accomplish the distance between Europe and the United States. The difficulty of carrying the necessary quantity of coals for the consumption of an engine acting, without interruption, from one shore of the ocean to the other, during a space of from 15 to 20 days, was no longer an obstacle. It had been discovered that the consumption of combustible did not increase in the same ratio with the power of the motors,—that an engine of 250 horse power, for instance, was far from burning twice as much fuel as was necessary for an engine of 125 horse power; that, moreover, certain parts of the mechanism might be simplified in such a manner as to take up less room, and consequently, leave more space at disposal for the accommodation of passengers or merchandize. From this time operations were commenced, and on the 4th of April, 1838, the first experiment was tried. You are all acquainted, gentlemen, with the result. You all beheld the enthusiasm excited by the success of the voyage undertaken by the Sirius, 15 days had been sufficient for its passage. Scarcely had this vessel arrived in the port of New York, when it was joined by the Great Western, which started from Bristol on the 8th of the same month, after a passage of 14 days.*

Henceforth the problem was solved. America was nearer the European continent by half the distance which formerly separated them. There could be no more doubt concerning it; the events which have since occurred have ratified these first expectations.

The Great Western has crossed the Atlantic 28 times during the period of the 14 months just elapsed without accident, maintaining an almost uniform speed, of which the average time was 16 days going, and 13 to 14 days coming back: the last voyage was even accomplished in 11½ days.

During two years since they began their operations, with what strides have the English advanced?

A first line from Bristol to New York was established in 1838. The company to whom it belongs has four steamers of 450 horse-power—namely, the Sirius, the Great Western, the Royal William, and the Liverpool. The price of each of these boats is 1,300,000f. It is said that they now are building an iron steamer, which is to carry two engines, whose united powers will amount to 1,000 horses. These engines were constructed on the plan of Mr. Humphreys; the boat will only be 100 meters in length, and will have room for 300 passengers, and a considerable quantity of merchandise. The works are in active continuation, and will be terminated, according to appearances, in the course of the year 1841.

Another line was established for the service of London and New York. Two vessels were employed on it—the British Queen and the President; the engine of the British Queen was of 500 horse-power, that of the President 600; they can accommodate from 225 to 250 passengers, and receive a load of from 500 to 600 tons. A third line connects New York to Liverpool, so that there are already three establishments sending steam-vessels from different parts of Great Britain to the United States.

Moreover, a compact was sealed on the 4th of July, 1839, between the Admiralty and Mr. Samuel Cunard for the transit of letters from Liverpool to Halifax. Mr. Cunard has engaged that there should be two departures per month, and receives from the Government an annual remuneration of 1,500,000f. The Britannia, of 450 horse-power, was launched into the sea in the beginning of February, 1839.

Lastly, a more extensive service will soon connect Great Britain with the West India islands: there is a company in existence under the name of the Royal Steam Navigation Company, which is preparing vessels for New Orleans, Mexico, and part of the South American coast. This company the Government indemnifies by an annual payment of 6,000,000f.

You must all perceive, gentlemen, that we must not delay entering into the lists, for we are urged on by competition from every quarter, and the appearance of English steamers on every point of the New World to the exclusion of our own would soon banish us from those regions.

However serious the character of these motives, gentlemen, they are, however, secondary when compared to a consideration which we will not endeavour to conceal. The navy is a weapon, and one which to all appearances is destined to play an important part in the conflicts which a future day may bring to light. Attempting to foretell what consequences may be reserved for a future period by the introduction of steam in constructing ships of war would be presumptuous; it is a question of entirely recent origin; experiments with regard to it are in their infancy. It is, however, already discernible that the use of new motors will infallibly produce the following effects:—In the first place, it will render every vessel in similar conditions equally supple and tractable, by whatever men she may be manned. It will be sufficient to have able engineers in order to effect manœuvres with a facility and precision as entirely independent of the state of the sea as of the greater or less aptitude of the sailors.

Secondly, the number and proportion of the men required for the performance of the ship's duty would be entirely changed. The Great Western, whose form and dimensions are nearly those of an ordinary frigate, is conducted by 50 men, including engineers and stokers. Now, if it be true that the naval enrolment of France is incompetent to supply all its necessities, this inconvenience will vanish; and the more so, because the zone in which we shall be able to find men fit for the service will be extended.

Lastly, the draught of water occasioned by a steamer depends upon its power; but for all it is less than that of ships of war. Whence it follows, that instead of the five or six ports to which our vessels and frigates can resort, steam-boats will be able to cast anchor off any coast, and, so to speak, in any bay.

Thus the new vessels provided with a good engine will be swift, will offer less hold to the enemy, will have a greater number of safe harbours to resort to, will require a less numerous crew, and require less previous apprenticeship than in sailing vessels. This will evidently become a new weapon; and if these ships carry guns for the discharge of bombs of a recent invention, whose effect is such that at one discharge they are capable of disabling the largest craft, they will become a weapon at once easy of management, safe, and of the most destructive nature. Is there not wherewithal here to change the whole direction of naval tactics, all the proportions existing between the powers of nations? Here is an entire revolution. Slow or fast, partial or complete, this revolution will ensue. Now, with the example given us by a Government whose energetical endeavours are dedicated to the continued increase of its naval resources, when we see Great Britain during two years continually multiplying, at the cost of such enormous sacrifices, its steam navigation, and finding in the gigantic establishments of its industry those inexhaustible resources of which we are deprived, would it be wise, would it be prudent to continue our *materiel* in its present state, to abstain from making some progress in the new career which has been traced out to us? Undoubtedly we do not indulge in the chimera that our country can ever equal the English in their naval establishment. The strength of the British nation rests entirely on its foreign trade; they are an exclusively seafaring nation. All the springs of its prosperity are there; it drags after it that colossal superiority which constituted at once its greatness and its peril. The conditions of existence in which France is situated are different; but the extent of its coast, its position, the genius of a portion of its inhabitants, compel it to possess a navy, and in that case it is becoming that, wherever she may be pleased to hoist her flag, she may be enabled to assemble and display a sufficient force in order to insure respect. Without this she could never effectually protect her national interests beyond the seas.*

The construction of steam-boats for transatlantic voyages presents, then, a double object to our view. Applied, in time of peace, to the growth and preservation of our commerce, they may be transformed, during hostilities, into ships of war; they may assume, in turn, the double character of a defensive weapon and of a means of conveyance—of a commercial and of a military navy; to-day they may carry merchandise, and when requisite guns.

STEAM PACKETS TO CONVEY THE MAILS BETWEEN FRANCE AND AMERICA.

We, Louis Philippe, King of the French, have proposed, the Chambers have adopted, we have ordered and do order the following:—

Article 1. A line of steam-packets shall be established in order to convey the mails between the ports of Havre and New York.

The Minister of Finance is authorized to treat, within the space of three months, with a commercial company who will undertake the service, on condition that they receive in payment an annual fee not exceeding 880f. per horse power. The number of steam-packets to be employed in the service of this line shall be three at the least, or five at the most; each packet to be propelled by engines of 450 horse power.

A list of conditions, to be drawn out by the administration, will determine the times of departure, the number of passengers, and every detail relative to the service of this line.

2. Two principal lines of communication shall be established by the Government, in order to convey the mails between France and America, and served by steam-packets of 450 horse power, one starting from Bordeaux every 20 days, and from Marseilles every month, in order to arrive at Martinique, and continuing by Guadaloupe, St. Thomas's, Porto Rico, Cape Hayti, and St. Jago, to Havannah; the other starting from St. Nazaire every month to Rio Janeiro, passing by Lisbon, Goree, Pernambuco, and Bahia. Three secondary lines, served by steamers of 220 horse power, will be established in order to continue the principal lines, the first to Mexico, touching at Vera Crux. Tampico. Galveston, and New Orleans; the second to Central America, touching at Chagres, Carthagena, Santa Martha, and La Guayra; the third to Montevideo and Buenos Ayres.

To effect this a special credit has been opened to the Minister of the Navy, to the amount of 28,400,000f., to be devoted to the construction, arming, and fitting up of 14 steam-packets of 450 horse power, and 4 steam-packets of 220 horse power, and which is to be appropriated to the expenditures of 1840, 1841, 1842, and 1843.

From the total sum of 28,400,000f. a grant is made to the Minister of the Navy—

	Francs.
1. For the year 1840, of	5,000,000
2. For the year 1841, of	10,000,000
Total	15,000,000

3. The steam-boats belonging to the Government shall be constructed so as to enable them, in case of necessity, to carry guns, and when performing the duty of packets to carry merchandise.

In the latter case the Government may either intrust them to the command of officers of the Royal navy or to sea-captains, whichever, in the interest of the service, it considers preferable.

4. When the command is intrusted to officers of the Royal navy, an agent commissioned by the administration shall be placed on board, and specially

---

* The length of this boat is 236 feet, its depth 23 feet 3 inches, its width outside the paddle boxes 58 feet 4 inches, draught corresponding to the load, 16 feet, tonnage 1,340 tons. The engines are so constructed as to diminish the consumption of steam and fuel. It is said that they consume 33 tons of coal a day. The total cost of the vessel when it was launched was 55,000*l.*; since that time improvements have been effected in it which have amounted to 15,000*l.* It carries 700 tons of goods, 135 passengers. The rest represents the weight of the engine, the boilers, and the water.

* England had, in 1831, 840 commercial steam-boats, representing altogether 64,700 horse power. Besides which, the English Admiralty possesses 66 vessels, whose powers amount to nearly 9,400 horses, while in France we reckon only 640 commercial steamers, and 38 belonging to Government.

intrusted with the details of the service, respecting the carriage of passengers, merchandize, bullion, and the mails.

5. The articles of the title 4 of book 2 of the Code of Commerce, determining the responsibility of sea captains towards the consignors and their assigns, will apply exclusively to the commissioned agent.

6. Ordinances, published in the form of administrative regulations, will determine all the details of the service of steamers undertaken by the Government.

7. The steam-packets which are under the direction of the state will be considered as part of the Royal navy, and the time served by seamen on these packets will be considered as in the service of the state.

8. Royal ordinances, inserted in the *Bulletin des Lois*, and the official portion of the *Annales Maritimes*, will fix the postage of the letters, journals, gazettes, and printed documents of every kind transmitted by the French Transatlantic packets.

Modifications introduced into the courses indicated in art. 2 will be published in the same manner, but such changes cannot take place with regard to the starting points in the kingdom or the general direction of the different lines.

9. The expences authorized by art. 2 will be provided for from the sums granted for 1840 and 1841 by the financial laws.

10. After the year 1842 the projected law for expenditures will include the demand of the funds necessary for carrying on the above lines of packets.

Steamers on the Pacific.—Extract of a letter from Captain Peacock, dated on board the Pacific Steam Navigation Company's steam-vessel Peru, lat. 9 15 N., long. 25 50 W., out 14 days from Plymouth :—"The Peru has hitherto had a most prosperous voyage, answering in every respect my most sanguine expectations. On leaving Plymouth we experienced a head wind, with a heavy cross swell, until the evening of the following day, when I ordered the fires to be burnt down, blew out the boilers, and made sail. On this first trial of sailing, although deep, we got seven knots out of her. There was a good deal of swell on, and the vessel occasionally rolled deep, but after a minute investigation of the moveable parts of the funnel, I saw no risk in lowering it, and in eight minutes from the commencement I had the gratification to see it snug in the chock, without straining a rivet or a rope-yarn. When the wind died away, we had every thing in its place again, and the fires alight in four minutes from hauling taut the main gears. The operation elicited the admiration of every one on board, and the correct workmanship of the arrangement reflects the highest credit on Messrs. Miller, Ravenhill, and Co. The funnel, when down in the chock, lies within the level of the paddle-box boats, and at a distance would resemble a long midship gun. It is completely out of the way of working the square mainsail, and when down, the operation of sweeping it is much simplified. We had only one entire day's sailing before getting into the trades, and then we had only three more. The trade wind was very light, except for two days out of the three, when, with the wind dead aft, with lower, topmast, and topgallant studding sails set, we went 11 knots for four consecutive hours, and in 24 hours ran 225 miles. This was the greatest run under sail. The least was 140, and this was the fifth day of sailing, when near the edge of the variables. We only consume half a ton of coals per hour on the average, and find no difficulty in keeping steam, without the additional length of funnel. The Hull coals are excellent; and in my own, as well as the chief engineer's opinion, are superior to the Llanelly coals. The sails all fit admirably, and the engines work extremely well. The vacuum now exceeds 28 in both. I perceive the great advantage of Sir W. Burnet's patent solution on the studding sails and awnings; it will increase their value 50 per cent. I am happy to inform you that my passengers are well, very contented, happy, and comfortable, which is daily expressed. I hope to be at Rio on the 26th day, of which there is every prospect."

Father Thames.—On Tuesday the 8th ult., an experimental trip was made with this new vessel intended to run from London to Gravesend. She is an iron boat, built by Messrs. Ditchburn and Mair, of Blackwall, and fitted with a pair of 37 horse oscillating engines by Messrs. Penn and Son, of Greenwich. She started from the Brunswick Wharf, Blackwall, with several Directors of the Blackwall Railway, and a party of scientific and naval gentlemen, at 21 minutes after 3, and arrived at the Pier, Gravesend, at 33 minutes past 4, making the trip in 1 hour and 12 minutes. She run the mile distance at Long Reach (with the tide) in 3 minutes 22 seconds, which is at the rate of 17·8 miles per hour. After staying at Gravesend for some time, she started off with the *Ruby*, the crack Gravesend boat; it was very soon perceived that Father Thames was making a head of the Ruby, and after running a short distance the Father went completely round her. The Father Thames then followed her, passed her again, and by the time she was off Blackwall, the Ruby was 2 miles astern. Messrs. Ditchburn and Mair have so constructed the bow of the vessel that she does not throw up the slightest wave in front, in fact we could scarcely perceive a ripple so clean did she cut through the water. This is an important improvement, and one that Mr. Ditchburn has been trying to obtain for many years, and who at length, we are happy to say, is successful.

ENGINEERING WORKS.

WOOLWICH DOCK-YARD.

THE extensive improvements taking place in this great naval depôt are such as will, in a short time, render it superior to any in the kingdom. The dry dock opposite the blacksmith's shop at the east end of the yard, is without exception the finest and most commodious that has ever been built, and is constructed of the most durable materials, being first laid in the bottom with one foot of brickwork, and over it large granite stones, about 3 feet 6 inches in thickness, and each many tons in weight. The base of this dock is 230 feet in length, and of a proportionate breadth; but it will contain vessels of upwards of 300 feet in length on the upper deck, owing to the manner in which it is constructed. At the west end of the dockyard excavations have been going on during the whole summer, for the purpose of making a dock of still greater dimensions, designed by Mr. Walker, engineer, and it is intended to lay the foundation stone in the course of a few days. The contractors for this dock, Messrs. Grissell and Peto, of York-road, Lambeth, have had great difficulties to contend with in making the excavations. At a few feet from the surface they came on a rich alluvial deposit, in which the hazel and other nuts and clumps of trees were found in a perfect state of preservation, and the leaves were in many instances in layers six feet thick. Under these was a considerable bed of concrete like blue clay, all of which had to be gone through before a safe gravelly bottom could be found. This has now been obtained, but not without great interruption from powerful springs rising in all directions, and it has required the constant and unceasing exertion of a 40-horse power steam-engine pumping night and day to enable the men to proceed with their labours. The dimensions of this dock will be 300 feet at the base, and, as it will be constructed on the improved principle, it will admit of vessels of 400 feet in length on the upper deck. This is considerably larger than any ever yet made, but it is anticipated that steam-vessels of this gigantic size will be laid down when docks capable of containing them for fitting and repairing are ready for their reception.

FISKERTON DRAINAGE.—The new steam water engine, for the better drainage of the fen-lands on the north side of the river Witham, between Fiskerton and Short Ferry, is at length upon the point of completion. A meeting of the proprietors was held at the City Arms hotel, Lincoln, on Friday, the 4th ult., for the purpose of hearing the opinion of Mr. Tuxford, engineer, of Boston, relative to the working of the engine, he being deputed to inspect the works, and to advance part of the contract money to Mr. Smith, of Belper, who furnished the building with the necessary works for the engine, and to decide upon paying him the remaining sum when the alterations pointed out by Mr. Tuxford were completed.—*Nottingham Journal.*

Woolwich.—The foundation stone of the new dock at Woolwich, was laid on Tuesday, 22nd ult., by Mr. Walker, the engineer, attended by the authorities of the dock-yard. The construction of this dock is different from any that has ever been made before. The stones are so cut that when placed together they will act on the same principle as an inverted arch. By this plan the greater the weight and pressure of the vessel in the dock, the greater the security that the bottom will not be raised by springs of water or from any other internal cause.—*Times.*

Liverpool Dock Committee.—At the meeting of this committee on Thursday, Sept. 17, Mr. Ald. Evans gave notice of his intention to move for a sub-committee to frame a Bill to Parliament for the construction of a new dock or docks, and warehouse on the docks and quays in this town.—*Liverpool Chronicle.*

PUBLIC BUILDINGS, AND IMPROVEMENTS.

The City of London and Tower Hamlets Cemetery, situated in the Mile End Road, comprising 22¼ acres of land, is now proceeding under the directions of Messrs. Wyatt and Brandon. The style of the buildings and enclosure will be Early English.

The Pedestal at Hyde Park Corner, placed in the centre of the crossing from St. Georges' Hospital to the entrance to Hyde-park, has been erected by the trustees of the Grosvenor-place District, and is about 100 feet westward of the district boundary. The pedestal which is circular, is executed in *Park Spring stone*, and is 2 ft. 8 in. diameter at the base, and 6 ft. 1 in. high. The column supporting three lamps is executed in cast iron, and is 7 ft. 9 in. high to the brackets, supporting the two side lights. The total height from the paving to the top of the centre light is 19 ft. 6 in. The whole pedestal is surrounded with Aberdeen granite kirb, enclosing a causeway 10 feet square, which is paved with Yorkshire stone, forming an octagon line round the base of the pedestal. An Aberdeen granite post 13½ inches diameter at the base, diminishing to the top, and 3 feet high is fixed at each angle of the causeway for the protection of foot passengers on their way from one side of the road to the other, being a distance of 87 feet. The top arrises of each of the plinths of the pedestal is chamfered off, and the cap (above a band upon which is inscribed "Grosvenor Place District, 1840"), molded for the purpose of preventing persons climbing up, and to obviate, if possible, the necessity of having the encumbrance of iron rails or spikes. The pedestal has been executed and fixed by Mr. Samuel Cundy, of Belgrave-wharf; the iron work by Messrs. Thompson, of Eccleston-street, East; the granite posts by Messrs. Thompson, of Millbank, Westminster, and the paving by the workmen belonging to the trustees, from designs and drawings, and under the superintendance of Mr. Turner, the surveyor to the trustees.

A Church in Bethnal Green, in the Early Lombardy style of architecture, is now being built under the directions of Messrs. Wyatt and Brandon.

Ramsgate Chapel.—This building is 110 feet in frontage, 60 feet in width, and 90 feet in height, to the top of the tower. The style of architecture is original, uniting the features of Saxon and Norman, with a slight indication of the Gothic, which are so designed and blended together that the whole building is kept in perfect symmetry of style throughout. The interior is fitted up in a kind of double theatre, having at each side rising seats, with a row of seats in the centre. The interior is plain, but would have been executed in a more elaborate style had not the limited funds prevented. There are galleries at each end of the chapel, one appropriated for the organ, and the other for children. The cost of the entire building is about £4,000, and is capable of containing 1400 persons. Mr. James Wilson, of London and Bath, is the architect.

A spacious building for the Southwark Literary and Scientific Institution, situated in the Borough Road, occupying a frontage of 50 feet by 70 feet deep, is now in course of erection; it will comprise a Library, Reading Room, Newspaper Room, Class Rooms, Lecturers' Room, and Librarian's apartments. Messrs. Wyatt and Brandon are the architects.

MISCELLANEA.

Improved methods of coating iron, under various circumstances, to prevent oxidation or corrosion, and for other purposes; patented by James Beaumont Neilson, Glasgow, Aug. 29.—The inventor claims the method of coating or covering iron, &c., by means of copper or alloys of copper, with zinc or tin. The copper or alloy is brought to that minute state of division in which it is obtained by precipitation from its solution, or it may be used in a granulated state. In order to cover cast-iron, sprinkle a thin coating of granulated, or other fine copper or alloy over the surface of the mould, to which may be added borax, or other flux, to facilitate the spreading or diffusion of the metal. Thus, when the molten iron is poured into the mould, the copper or alloy will be fused, so as to cover the casting, and render it secure against oxidation or corrosion. If malleable iron is to be coated, put a covering of the pulverised copper or alloy over the upper surface of the iron, while it is being heated, and the borax or other flux will soon cause it to spread over the heated part, which should be plunged into water, to detach the scale of oxide that forms upon it.—*Inventor's Advocate*.

Improvements in apparatus for withdrawing air or vapour; patented by Samuel Carson, Caroline-street, Euston-square, Aug. 5.—The inventor states, that revolving heads with cones have been applied to chimneys, in order to improve the draft thereof, but in such case the cones have not been made of sufficient length to pass beyond the opening of the chimney; hence the same has been of little use, owing to the wind being blown down the chimney. First improvement is for withdrawing heated air from chimneys, by means of the atmospheric air blowing through a cone, situated in a cylindrical box that revolves, at the chimney top, by the aid of a vane or weathercock; the wind passing through this cone, the orifice of which extends beyond the opening of the chimney or shaft, causes by its attraction or draft the smoke from the fireplace, or rarified air of the chamber, to rise with velocity, and pass round the casing connected to the chimney by a revolving joint. Second improvement consists in bringing the pipe that is to carry off the condensed or heated air of an apartment, down to the conical apparatus situated near a jet of steam, or near the waste steam-pipe of a boiler. In place of the atmospheric air passing through the cone, a jet of steam is made to draw off the confined air of the chamber, or from the bottom of a mine. Third improvement is to introduce a jet of steam into a chamber, without the use of a cone, whereby the vacuum is produced, and the confined air passes up from the mine or chamber through the valve at the upper orifice of the tube. This improvement we have examined at the Polytechnic establishment, where it works beyond all expectation, and we have since learned that Mr. Brunel has allowed Mr. Carson to introduce it at the Thames tunnel, where a four-horse engine cannot sufficiently ventilate the shaft; by this improvement, the waste steam alone will perform the whole operation.—*Ibid.*

Materials used in lighting or kindling fires; patented by Richard Edwards, of Fairfield-place, Bow, Middlesex, Aug. 29.—In the ordinary faggots of wood, used for lighting fires, there is not sufficient ventilation to allow the wood to burn, in case it be used in the close form of a bundle, but by this improvement, the pieces of wood are so combined with rope, cotton, paper, or other such like material, as to leave a space between each slip of wood or reed; thus it becomes what the inventor terms a "Ventilated Faggot," which may have its ends dipped into pitch, tar, resin, liquid sulphur, or other inflammable matter. By throwing one of these "ventilated faggots" into a fire-place, the coals may be heaped over it, and the servant, or other individual, will find no difficulty in causing the fire to burn after it is once lighted.—*Ibid.*

An improved method or methods of adjusting, shifting, and working theatrical scenery and apparatus; patented by Rowland Macdonald Stephenson, Upper Thames street, civil engineer, Aug. 29.—The object proposed by the patentee is the greater speed and facility with which stage scenery may be brought forward, shifted, or removed. The arrangement about to be described, provides means for shifting or removing simultaneously, and without noise, 35 distinct pieces of scenery, viz., 10 side scenes removed and 10 fresh subjects brought forward; five sets of clouds removed and five substituted; and five main scenes removed. The general arrangement of the machinery for effecting the above, may be described as follows:—The interior of the house between the basement and the roof may be said to be divided into four floors or compartments, viz., 1. a raised platform, on which the gearing for working the stage-traps is to be placed. 2nd. The stage with traps of various forms and dimensions, including a considerable portion formed to rise or fall by suitable machinery, and called the sinking stage. 3rd. The lower flats, between which and the stage are placed the wing scenes: between the framing formed by the girders and the supporting columns, and stretching from side to side of the stage, are suspended the border frames, which can be raised or lowered by means of ropes passing over drums and connected with counterpoise weights; and fourthly, the upper flats upon which the inventor places the moving power to communicate motion to the whole. On each side of the stage on the upper flat, are placed a series of frames called main scene carriages, having racks, which can be connected with pinions or long horizontal shafts when required to be moved backwards or forwards; these two shafts are connected at their extremities by a third shaft. From the upper horizontal shafts, by means of bevel gear and vertical rods, on the lower ends of which are drums, an endless chain is driven horizontally in either direction, to which are attached the borders representing clouds, foliage, arches, &c. The side frames, of which the number is limited by the depth of the stage, may be either flat, circular, or triangular; in the present case they are triangular, and receive a forward, backward, or rotatory motion, or both at pleasure, and can be placed at any convenient angle to the audience, so as to represent closed doors, &c.; at every change of the scene they will be moved round 130 degrees, or one-third of a circle; the whole of the side frames may be moved together or separately, by means of gear connected with the moving power on the upper flat. Attached to the centre of the border frames, and revolving on a pivot, are the traversing frames for crossing the stage in any direction, and at any given inclination; these, when ready for use, are raised up and secured at one end so as to form an inclined plane, and the object to be traversed having been attached to a wire passing round a drum fixed in a heavy frame, will descend by its own gravity. The trap-frame consists of a rectangular platform traversing on the lower or fixed platform, and having an upright frame of iron mounted on rollers and capable of being traversed on the lower platform in any direction; when brought under the aperture in the stage, it allows the trap to be sunk steadily by bearing on a disc or square iron plate, counterbalanced by weights. The claim is to the improved mode of shifting and working scenes and theatrical machinery, and to the obvious modifications of which the above arrangements are susceptible. —*Ibid.*

Improvements in the stuffing boxes of lift pumps; patented by James Horne, Clapham Common, Esq., March 3, 1840.—These improvements consist in the application of two cupped leathers to the purpose stated, in the following manner: the stuffing-box consists of a metal collar and cap, each having a projecting ring or shoulder on the inside; two pieces of leather are blocked into the form of cones with a horizontal base, having an aperture at the apex just large enough to receive the piston-rod; one of these cones is placed upon the piston-rod with its apex downwards, its base resting upon the shoulder in the collar of the stuffing-box; a metal disc is then slipped on to the piston-rod, and afterwards the second leather cone with its apex upwards, its base resting upon the metal disc; the stuffing-box cap is then put into its place, and screwed down tight. The metal disc becomes a guide for the piston-rod, while the pressure of the fluid below, and of the air above, upon the external surfaces of the two cupped leathers, keeps all tight. The arrangement is doubtless a good one, but we think the patentee would hardly have gone to the expence of a patent, had he been acquainted with the more beautiful, as well as more ingenious mode of constructing stuffing-boxes, employed by Bramah in his hydraulic press half a century ago; and which has proved efficient under greater pressures than a lift pump can possibly be exposed to. —*Mechanics' Magazine.*

Petroleum Oil Well.—About ten years since, whilst boring for salt water, near Burksville, Kentucky, after penetrating through solid rock upwards of 200 feet, a fountain of pure oil was struck, which was thrown up more than twelve feet above the surface of the earth. Although in quantity somewhat abated after the discharge of the first few minutes, during which it was supposed to emit seventy-five gallons a minute, it still continued to flow for several days successively. The well being on the margin and near the mouth of a small creek emptying into Cumberland river, the oil soon found its way thither, and for a long time covered its surface. Some gentlemen below applied a torch, when the surface of the river blazed, and the flames soon climbed the most elevated cliffs, and scorched the summit of the loftiest trees. It ignites freely, and produces a flame as brilliant as gas. Its qualities were then unknown, but a quantity was barrelled, most of which soon leaked out. It is so penetrating as to be difficult to confine in a wooden vessel, and has so much gas as frequently to burst bottles when filled and tightly corked. Upon exposure to the air it assumes a greenish hue. It is extremely volatile, has a strong, pungent, and indescribable smell, and tastes much like the heart of pitch pine. For a short time after the discovery, a small quantity of the oil would flow whilst pumping the salt water, which led to the impression that it could always be drawn by pumping. But all subsequent attempts to obtain it, except by a spontaneous flow, have entirely failed. There have been two such flows within the two last years. The last commenced on the 4th of July last, and continued about six weeks, during which time about twenty barrels of oil were obtained. The oil and the salt water, with which it is invariably combined during these flows, are forced up by the gas, above two hundred feet, into the pump, and thence through the spout into a covered trough, where the water soon becomes disengaged and settles at the bottom, whilst the oil is readily skimmed from the surface. A rumbling noise resembling distant thunder, uniformly attends the flowing of the oil, whilst the gas, which is then visible every day at the top of the pump, leads the passing stranger to inquire whether the well is on fire.—*Silliman's Journal.*

Napier's Patent Shot Machine.—The Board of Ordnance have determined upon employing Napier's machine for making balls by compression at the Royal Arsenal, Woolwich; it is to be worked by steam, as also the turners and borers of cannon. At present, the same system as was in vogue forty years ago, is used in the boring of large guns, horses being employed as the moving power. This alteration will relieve about ten artillerymen who have charge of the horses employed in this duty.

Hint for House Decorators.—The walls had a novelty of decoration not peculiar to Affghanistan, as I have seen it in India, though never so well done as in the rooms I speak of; the chunam or plaster being stamped when moist or plastic, and worked into a pattern, over which a varnish of powdered talc is spread, which more nearly resembles the richness and hue of new and unused frosted silver plate than anything I have seen elsewhere. This might be introduced in London as a very cheap and elegant drawing-room decoration.—*Dr. Kennedy's Campaign of the Army of the Indus.*

Locomotive.—Mr. E. Rudge, of Tewkesbury, tanner, has obtained a patent for a new method or methods of obtaining motive power for locomotive and other purposes, and of applying the same. These improvements are for the construction and application of a new form of atmospheric engine, which may consist of two, three, or more open topped cylinders, placed either vertically or horizontally, the piston rods of which are connected with two or three throw cranks. The air below each piston in the cylinder is condensed by a jet of steam, when the preponderating influence of the atmosphere on the external surface of the several pistons produces the available power. The cylinders are lubricated by means of a small funnel on the top of the piston rod, whence the oil flows into a hollow space within the rod, and thence into a groove turned in the piston. In order to gain a reserve of power, for any particular purpose, a large cylindrical receiver is filled by a condensing air-pump placed on either side, and connected with the main shaft of the engine; thus when the carriage is descending the hill, the air-pumps will compress the air into the large cylinders, which again will supply the air for working the pistons while ascending a hill.—*Gloucestershire Chronicle.*

LIST OF NEW PATENTS.

GRANTED IN ENGLAND FROM 30TH AUGUST TO 26TH SEPTEMBER, 1840.

William Daubney Holmes, of Cannon-row, Westminster, Civil Engineer, for "*certain improvements in naval architecture and apparatus connected therewith, affording increased security from foundering and shipwreck.*"—Sealed September 3; six months for enrolment.

Thomas Horne, of Birmingham, Brass Founder, for "*improvements in the manufacture of hinges.*"—September 3; six months.

James Bingham, of Sheffield, Manufacturer, for "*certain improved compositions which are made to resemble ivory, bone, mother of pearl, and other substances applicable to the manufacture of handles of knives, forks, and razors, pianoforte keys, snuff boxes, and various other articles.*"—September 3; six months.

William Freeman, of Millbank-street, Stone Merchant, for "*improvements in paving or covering roads and other ways or surfaces.*" Communicated by a foreigner residing abroad."—September 7; six months.

Thomas Motley, of Bath Villa, Bristol, Civil Engineer, for "*improvements in apparatus and means of burning concrete fatty matter.*"—September 7; six months.

William Coltman, of Leicester, Framesmith, and Joseph Wall, of the same place, Framesmith, for "*their invention of improvements in machinery employed in framework knitting or stocking fabrics.*"—September 7; six months.

John Whitehouse, the younger, of Birchall-street, Birmingham, Brass Founder, for "*improvements in the construction of spring hinges and door springs.*"—September 7; six months.

Samuel Parker, of Piccadilly, Manufacturer, for "*improvements in apparatus for preserving and purifying oils, and in apparatus for burning oils, tallow, and gas.*"—September 10; six months.

Mark Freeman, of Sutton Common, Gentleman, for "*improvements in weighing machines.*"—September 10; six months.

Paul Haninc, of Clement's Lane, London, Solicitor, for "*improvements in the construction of governors or regulators applicable to steam engines, and to other engines used for obtaining motive power.*" Being a communication.—September 10; six months.

Charles Delbruck, of Oxford-street, Gentleman, for "*improvements in apparatus for applying combustible gas to the purposes of heat.*" Being a communication.—September 10; six months.

Edward John Dent, of the Strand, Chronometer Maker, for "*certain improvements in clocks and other time keepers.*"—September 10; six months.

Henry Houldsworth, of Manchester, Cotton Spinner, for "*an improvement in carriages used for the conveyance of passengers on railways, and an improved seat applicable to such carriages and other purposes.*"—September 10; six months.

Hugh Lee Pattinson, of Bensham-grove, Durham, Manufacturing Chemist, for "*improvements in the manufacture of white lead.*"—September 10; six months.

George Alexander Gilbert, of Southampton-buildings, Gentleman, for "*certain improvements in machinery, or apparatus for obtaining and applying motive power.*"—September 10; six months.

Robert Goodacre, of Allesthorpe, Leicester, for "*an apparatus for raising heavy loads in carts, or other receptacles containing the said loads, when it is required that the unloading should take place at any considerable elevation above the ground.*"—September 10; six months.

James Pilbrow, of Tottenham, Engineer, for "*certain improvements in steam engines.*"—September 10; six months.

William Bedford, of Hinckley, Leicestershire, Frame-work Knitter, for "*certain improvements in machinery employed in manufacturing hosiery goods, or what is commonly called frame-work knitting.*"—September 17; six months.

Henry Fourdrinier and Edward Newman Fourdrinier, of Hanley, Stafford, Paper Makers, for "*certain improvements in steam engines for actuating machinery, and in apparatus for propelling ships and other vessels on water.*"—September 17; six months.

Moses Poole, of Lincoln's Inn, Middlesex, Gentleman, for "*improvements in preparing materials to facilitate the teaching of writing.*" Being a communication.—September 17; six months.

Walter Richardson, of Regent-street, Gentleman, and George Mott Braithwaite, of Manor-street, Chelsea, Gentleman, for "*improvements in tinning metals.*" Being a communication.—September 17; six months.

Samuel Draper, of Nottingham, Lace Manufacturer, for "*improvements in the manufacture of ornamented twist lace, and looped fabrics.*"—September 21; six months.

William Mill, of Blackfriar's-road, Engineer, for "*certain improvements in propellers, and in steam engines, and in the method of ascertaining and measuring steam power, parts of which improvements are applicable to other useful poposes.*"—September 21; six months.

Charles Handford, of High Holborn, Tea Dealer, for "*an improved edible vegetable praparation called* 'Eupooi,' *and the mode of manufacturing the same.*"—September 21; six months.

Thomas Pain, Junior, of Upper Seymour-street, Euston-square, Student at Law, for "*a plan by means of which carriages may be propelled by atmospheric pressure only, without the assistance of any other power, being an improvement upon the Atmospheric Railway now in use.*"—September 22; six months.

John Maughan, of Connaught Terrace, Edgeware Road, Gentleman, for "*certain improvements in the construction of wheeled carriages.*"—September 24; six months.

George Goodman, of Henley, near Birmingham, Needle Manufacturer, for "*certain improvements in the manufacture of mourning and other dress pins.*"—September 24; six months.

Thomas Muir and John Gibson, of Glasgow, Silk Manufacturers, for "*improvements in cleaning silk and other fibrous substances.*"—September 24; six months.

William Hirst, of Leeds, Clothier, for "*improvements in the manufacture of woollen cloth and cloth made from wool and other materials.*"—September 24; six months.

Henry Pinkus, of Panton-square, Coventry-street, Esquire, for "*improvements in the method of applying motive power to the impelling of machinery applicable amongst other things to impelling carriages on railways on common roads or ways and through fields, and vessels afloat, and in the methods of constructing the roads or ways on which carriages may be impelled or propelled.*"—September 24; six months.

John Johnston, of Glasgow, Gentleman, for "*a new method (by means of machinery) of ascertaining the velocity of a space passed through by ships, vessels, carriages, and other means of locomotion, part of which is also applicable to the measurement of time.*"—September 24; six months.

Pierre Erard, of Great Marlborough-street, for "*improvements in pianofortes.*"—September 24; six months.

Thomas Robinson Williams, of Cheapside, Gentleman, for "*improvements in the manufacture of woollen fabrics or fabrics of which wools, furs or hairs are the principal components, as well as for the machinery used therein.*"—September 24; six months.

Alexander Dean and Evan Evans, of Birmingham, Millwrights, for "*certain improvements in mills for reducing grain and other substances to a pulverised state and in the apparatus for dressing or bolting pulverised substances.*"—September 24; six months.

TO CORRESPONDENTS.

Communications are requested to be addressed to "The Editor of the Civil Engineer and Architect's Journal," *No.* 11, *Parliament Street, Westminster.*

Books for review must be sent early in the month, communications on or before the 20th (if with drawings, earlier), and advertisements on or before the 25th instant.

J. D., *the substance of his communication on Suspension Bridges has appeared in print before.*

"*A Student,*" *his communication will be noticed next month.*

J. I., *his communication dated 18th ult., was not received until the 24th, when it was too late to comply with his request.*

"*A Constant Reader,*" *it is difficult for us to give the names and addresses of the inventors at all times, it would subject us, in many instances, to be charged with the advertisement duty.*

"*A Constant Subscriber,*" *shall be answered next month.*

G.'s *work was not received until near the end of the month, it shall be noticed in the next Journal.*

A Subscriber wishes for the address of the agent for supplying the Porcelain Letters, noticed in our Journal in May last.

Books received—Scott's Cotton Spinner; The Process of Blasting by Galvanism; On Excavation and Embankment on Railway; Thoughts on Steam Locomotion; and Experiments on the Compass on Iron-built Ships; they will be noticed in the next Journal. We have been compelled to postpone farther notices of Mr. Mushet's valuable work, and also Mr. Bartholomew on Specifications.

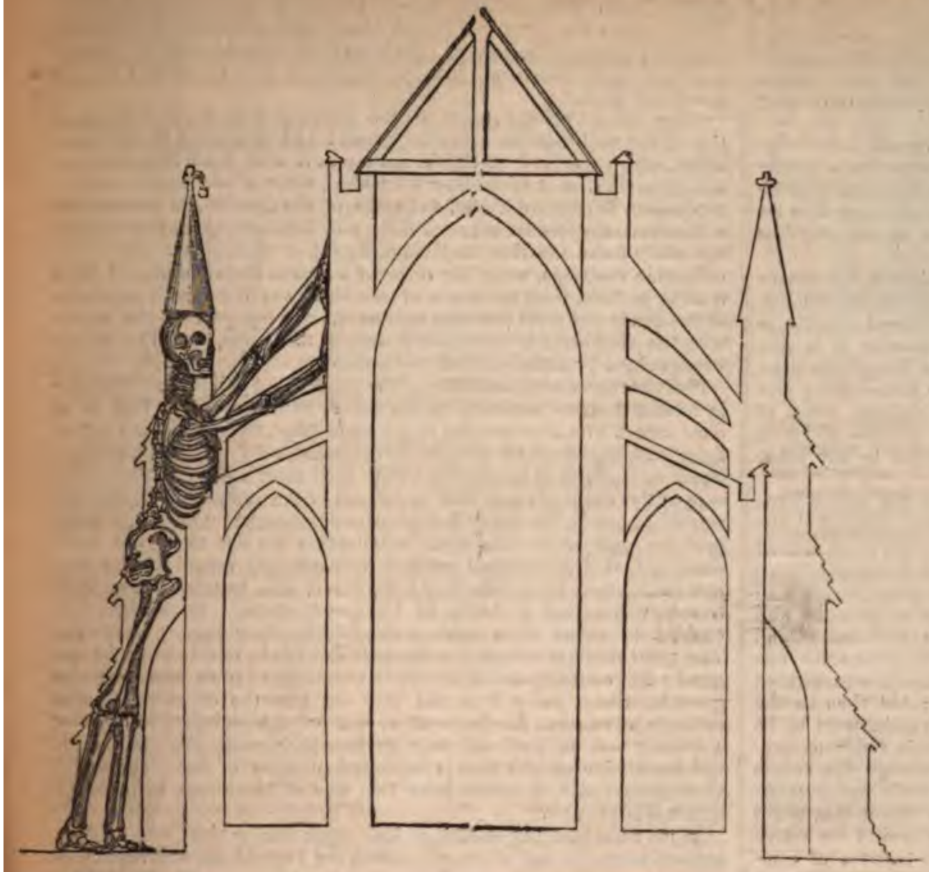
Next month we shall give the Plan of the Principal Floor and Section of the Reform Club.

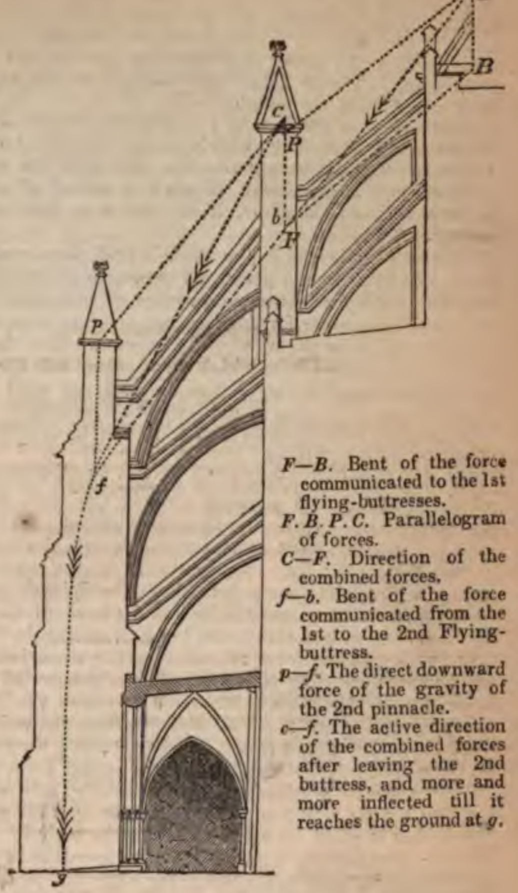
ERRATA.

In the August number, column 2. *page* 287, *paragraph* Steam Tug, *for* Buld *read* Bald; *for the velocity of wheel* 4·58 miles *read* 14·58 miles.

In the September number, page 321, *column* 2, *for* Tomson's *read* Thomson's.

ON BUTTRESSES, PINNACLES, &c.





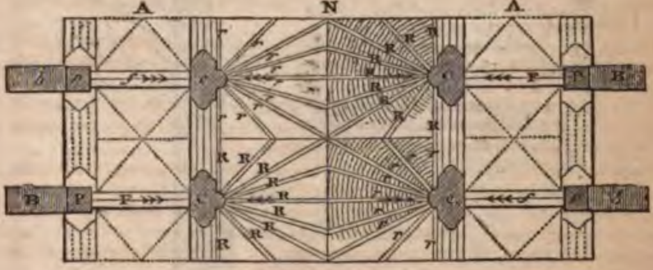
F—B. Bent of the force communicated to the 1st flying-buttresses.
F. B. P. C. Parallelogram of forces.
C—F. Direction of the combined forces.
f—b. Bent of the force communicated from the 1st to the 2nd Flying-buttress.
p—f. The direct downward force of the gravity of the 2nd pinnacle.
c—f. The active direction of the combined forces after leaving the 2nd buttress, and more and more inflected till it reaches the ground at *g*.

ON BUTTRESSES, PINNACLES, &c.

By Alfred Bartholomew, Architect.*

Were it the author's wish to prove by one example more striking than any other, the falling off of science in the absolute practice of architecture, in these times of pretended superiority, in which the ill-taught practitioner who wishes to pursue the integrity of his art, is obliged, after he is turned adrift by his master, to re-educate himself as far as he is able, by picking up whatever scraps of scientific information may fall in his way, instead of receiving from his master at once the full depth of skill which the free-masons for centuries handed down from father to son, from master to pupil, without diminution and without reserve,—he would fearlessly instance the most singular advancement which the mid-eval architects seem, by nothing short of inspiration, to have made in the most delicate acquaintance with *Architectural Dynamics;* a knowledge which taught them at once to unite in their abutments, strength with economy, use with beauty: while in our ignorance we fancy that strength and economy are enemies of each other and that use and beauty are of necessity opposite qualities. This refined intelligence taught them to render every necessary part of their constructions such exquisite ornaments, that the ignorant modern looking at them, without knowing their use, fancies them to be merely ornamental.

They first began in their vaultings with reducing the lateral thrust of the work to the smallest limits, by cutting out all the otherwise more level and hazardous parts of the vaulting, so that what remained scarcely left its perpendicular bearing upon the walls: they next greatly reduced further the weight of the vaulting, by forming it of small stone ribs, with a mere thin cuticle of lighter materials in short and narrow panels between the ribs; and whereas in our modern brick vaultings, the groin-points are weak by their bond, and are still weaker from the soft and inferior nature of the bricks of which they are composed (vulgarly termed "*cutters*," and wholly unfit for the purposes of any *good* work), and we know scarcely any thing of the *dynamics* of such a vault,—the mid-eval builder put all the strength in the ribs, strutted his ribs across as he deemed necessary, and made every strut a beauty, conducted the active force down those ribs as easily as water is conducted down a pipe, and then, instead of leaving the active force within each rib to expend itself in committing unknown and unrestrained damage to the walls of the fabric, he united their force in one point so that he could deal with it as an active power well ascertained; then knowing by the laws of the resolution of forces the way in which the united thrust of the ribs would move, he counter-acted by the



N, nave. A, A, aisles. R, R, &c., ribs of the vaulting, the several thrusts of which all uniting at the centre C; the dynamic action is confined to one point tending to move from C to F. F, flying-buttress, falling against the point C, in the direction exactly suited for opposing the united thrust of the vaulting-ribs. B, wall-buttress from which the flying-buttress springs. P, pinnacle. The small letters indicate the repetition of sets of the same parts belonging to other divisions of the vaulting.

---

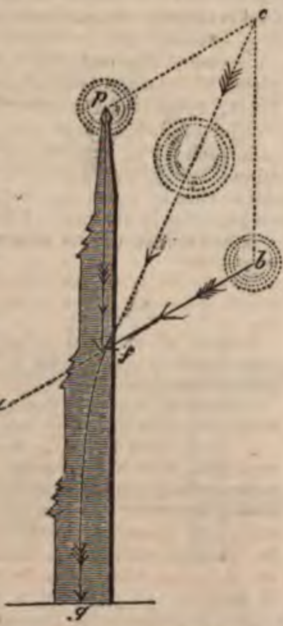
* We have through the kind permission of the author, taken this paper from a work recently published by him, entitled, "Specifications for Practical Architecture; preceded by an Essay on the decline of excellence in the Structure and in the Science of Modern English Buildings."

smallest possible quantity of materials set in the form of flying-buttresses, pinnacles, and wall-buttresses, that force which unrestrained might have endangered the walls. Thus by making use of only a small quantity of materials, every particle of which was brought into active service, he was enabled to carve ornament and enrich every part of his fabric out of those funds which we ignorant moderns expend in raising coarse masses which perform no duty, or ill-directed either waste much of their weight and strength, or else employ it in rending and dilapidating the fabric.

The author comes now to a department of the dynamic knowledge of the Gothic architects, which, as he believes it outstrips in combination of skill and beauty all other efforts of the architectural practitioner, ancient or modern, affords him matter of surprise, that as far as he knows or remembers, it has not been noticed by any previous writer.

The manner in which the Gothic architects conducted the active force of a vault to one place, and then with practical certainty counter-abutted that force by a small quantity of materials placed exactly in the situation proper for the purpose, has just been shown; it is now proposed to show the wonderful manner in which the flying-buttresses, the wall-buttresses from which they spring, and the surmounting pinnacles, are together disposed so as with the most delicate union of the extreme of beauty, to unite the most wonderful economy and such a knowledge of mechanics as will in vain be sought for in any other description of buildings.

Having found out exactly the precise place where the active force of the vaulting was pressing against the wall, they distended the *flying-buttresses* or *arc-boutant* widely at that part, in the same manner as a modern carpenter, in *temporary-shoring*, places a board flat against a dangerous wall; they then gradually concentrated this distention of the wall-thrust into one point, where the flying-buttress joins the wall buttress; thus they concentrated at the head of the wall-buttress, all the active force communicated by the vaulting, in the same manner as in wrestling all the force received by the arms becomes concentrated in the spine, pressing its vertebræ closely together; but then as the operation of this force, would have required the wall-buttress to be made sprawling out to a vast distance from the wall, in order to prevent the active power from throwing it over, they change the course of the active force, simply by running up the head of the wall-buttress in the form of a pinnacle, which, having only a direct downward gravity, by the *resolution of forces*, so changed the course of the active force, that it could be confined within the body of a buttress of comparatively moderate dimensions,—the downwardly-increasing gravity of the wall-buttress in fact mingling with the force communicated to it, curved the direction of the force more and more inwards, till it was eventually re-diffused horizontally over the broad foundation of the buttress, and was from thence communicated to the earth itself. Thus pinnacles, which are vulgarly considered merely as ornaments, became the most refined instruments in the economy and security of ecclesiastical and other buildings, and like the position of the human head, had a most material influence upon the stiffness and activity of the whole frame. With this knowledge, it was, that the Gothic architects proportioned the weight and size of their pinnacles, and when we see them assuming an extraordinary altitude, as at Worcester Cathedral, it is not from idle, wild, or luxuriant caprice, but because extraordinary means were required in order to change suddenly the course of an active power, which would otherwise have expended itself beyond the body of the abutment, and by displacing it, have brought to ruin the whole work.[*]



f—b. Bent of the force communicated to the flying-buttress by the *drift* of the vaulting, which force would proceed unrestrained to *u*, if the pinnacle were removed, and would consequently drive over the wall-buttress in that direction.

p—f. The direct downward force of the gravity of the pinnacle.

—f. The active direction of the two combined forces above-stated, more and more restrained in its downward course, within the body of the wall-buttress, till it reaches the ground at *g*.

f, b, p, c. Parallelogram of forces.

They did not always stop here, for knowing that there was a portion of the wall-buttress near the ground and adjoining to the side aisles, which received no thrust, and lay as it were dead, this they cut out altogether, as at Gloucester Cathedral, some of our English Chapter-houses, Westminster-hall, and some of the Continental Cathedrals which have chapels set between their wall-buttresses;[†] so that in fact, the whole form, position, and management of the counter-abutments of Gothic vaultings, were like those of a human skeleton, placed in a leaning posture, with the bones of the legs away from the base, those of the hands and arms pressing against the moving part of the vault, with the skull erect to confirm and steady the spine, and the whole strengthened by sufficient flesh and muscle.

That the true mechanical office of the pinnacles of pointed architecture is as stated above, appeared to the author to be so evident, that it at once struck him after coming to this knowledge, that the double set of flying buttresses on the south side of Westminster Abbey, must be respectively inclined, so as to receive within their solid substance the pressure of the vaulting; and that on account of the operation of the two sets of pinnacles, the lower flying-buttresses must be set more uprightly than the upper ones; this upon examination proved to be the case, showing that if the original builders were not fully versed in the subject (which may be greatly doubted), Wren, who restored these buttresses, was so, and probably by his great scientific knowledge, was enabled to adjust them more accurately to their proper positions. The great masters who had to do with this fabric, could not avoid the great extra consumption of materials which arose from removing the great buttresses away from the wall out into the cloister-green, in order to leave room for the north avenue of the cloister; but having a difficult task to perform, they performed it with admirable skill, and knowledge greater than is exhibited in many of the Continental Cathedrals, some of which have two sets of buttresses in order to admit side chapels.

With what humility should we look upon our modern use of buttresses, pinnacles and abutments, which we pretend are the results of a far outstripping science, and of an improved taste,—while men whom we have been in the habit of calling barbarians, have in a dark age (more enlightened in many things than the best ages of Greece and Rome) at once mingled in their works, poetry, economy, taste, strength, and invention.

Geometrical Survey.—The officers of the engineers appointed to conduct the survey of the island have been for the last six weeks stationed upon the top of Ben Volich, a high and peaked mountain in Rannoch, east of Lochgarry. They had spent the greater part of the summer on Schihallion, but the severity of the weather of late has both both impeded their operations and rendered the station very uncomfortable. For the last fortnight the snow has been lying some inches deep around their very superficial temporary dwelling, and the carriage of fuel from the surrounding districts is at once expensive and precarious. The view from this moutain, as well as from Schihallion, is very extensive from their commanding altitude, and enables the engineers to take a very wide observation.—*Scotch Paper.*

---

[*] Rondelet in his "*Traité Théorique et Pratique de l'Art de Bâtir,*" shows that he had sagacity enough to find out the beauty of the whole management of the dome of St. Paul's, and that he saw plainly the consolidating effect which the weight of the covering of the dome has upon the hollow cone; but it is singular that this sagacity did not preserve him from in some sort deprecating the oblique meeting of the cone with its supporting piers; he did not perceive, that besides the enormous collection of surrounding abutments which the great cone possesses, the perpendicular extension of the external peristylium above the foot of the cone, acts so as by the resolution of forces to materially change the direction of any expanding thrust which the base of the cone may possess, and to confine it strictly within the bodies of the first set of piers.

[†] Mr Savage, at the New Chelsea Church, has omitted the inactive parts of the wall-buttresses in order to admit a free passage in the dry areas which surround the basement-story of the edifice; but he has not changed the *drift* in the flying-buttresses by placing pinnacles over the wall-buttresses; allowing the present wall-buttresses of the church to be sufficient, the present combustible ceilings over the galleries of the church might be exchanged for groined roofs of stone, and the addition of pinnacles would still confine the drift within the present wall-buttresses, notwithstanding the added drift of the new side vaults.

ON CLOTHING OF STEAM BOILERS.

Report upon the advantages to be derived from Clothing Steam Boilers, Pipes, Cylinders, &c., with the Patent Felt, manufactured by Messrs. Borradaile, Whiting, and Company.

By Thos. Wicksteed, Mem. Inst. Civil Eng., Hon. Mem. Roy. Cornish Polytech. Soc., &c. &c.

[We feel much pleasure in being able through the kindness of Messrs. Borradaile and Co., to give to our readers the following very valuable report on Clothing of Steam Boilers and Cylinders, and which we are sure will be perused with much interest. We must here observe that too much praise cannot be given to those gentlemen for the spirited manner they have had the experiments made, which could not have been done excepting at a very large outlay. We think after a careful study of this report by those who have a steam engine not already clothed, they will hesitate no longer in adopting that very essential requisite, which we are sorry to say has been, heretofore, most shamefully neglected. The experiments were conducted under the direction of Mr. Wicksteed, the eminent engineer of the East London Water Works, whose abilities are too well known to the profession to need any praise on our part for the very elaborate manner he has performed his task.]

Upon the 25th of April last, Mr. Francis Whiting called and requested me to give an opinion as to the advantages of using Borradaile's Patent Felt as a non-conductor; and to state what I considered was the actual amount of saving in fuel obtained in the use thereof as a clothing for steam-boilers, cylinders, &c. I stated that, although I never had had the opportunity of trying experiments, I was satisfied it was a good non-conductor, and as the amount of saving stated as having been obtained by those that had used it varied from 6 to 17 per cent., I thought it would be advisable to try a series of experiments upon a large scale, continued for so long a time that the *experience* obtained should put at rest all question as to the actual amount of saving.

Mr. Whiting approved of this suggestion, and gave me instructions to try any experiments I thought proper.

In pursuance of these instructions I determined to ascertain the quantity of water evaporated by a given weight of coals, when the boiler, steam-pipes, and flues were exposed, or not clothed, and also when they were clothed with one, two, three, and four coats of the Patent Felt respectively; having been in the habit also of using hop sacking as a covering for the boilers, I determined to ascertain the evaporative power of the boiler when clothed with three and five coats of hop-sacking respectively, these experiments would give me the proportionate amount of fuel required to evaporate a given weight of water under the different circumstances before stated.

To ascertain the saving obtained by the use of the Patent Felt in clothing the cylinder, nozzle, and steam-pipes, I determined to ascertain the quantity of water that was required to pass through the cylinder in the form of steam, to do the duty of one horse, when the cylinder, steam-pipes, &c., were exposed, or not clothed, and when clothed partially, or wholly, with Patent Felt, as described in Table No. IV. appended to this report.

The boiler on which the experiments were tried was made by Boulton & Watt; it was of that form called wagon-headed, with a flue passing through the centre, the fire being underneath; the dimensions were as follow:

	Ft.	In.
Length of boiler	24	0
Depth	8	8
Width in widest part . . .	5	11
Width of flue passing through the centre .	2	6
Depth of ditto ditto .	3	0

The engine, which was a single pumping-engine, was made by the same parties, the cylinder 60 inches in diameter, and average stroke 7ft. 11in.; the cylinder had a steam jacket around it.

A long series of experiments was made, the details of which are given in Tables Nos. 1, 2, 3, and 4, appended to this report.

Before commenting upon the experiments, I will give an explanation of the Tables, to show in what way the different results have been arrived at.

Table No. I.

The columns 1 and 2 require no explanation.

Column No. 3, shows the number of hours the engine was at work per diem of 24 hours.

Column No. 4, gives the bushels of coals consumed, which were accurately weighed, each bushel weighing 84 lb., being the weight of the imperial bushel.

Column No. 5, gives the weight of water in hundred weights introduced into the boiler every 24 hours, the way in which this was ascertained was as follows:—There were two cisterns of given dimensions placed one above the other, the top one communicating with the feed pump of the engine, having an overflow, or waste water-pipe attached to it, and a valve in the bottom to let water into the lower cistern when required; the lower cistern communicated with the boiler, supplying it in the ordinary way adopted for low pressure boilers; the lower cistern was gauged, the gauge being divided into hundred weights, the divisions being obtained by actually weighing the water into the cistern; the lower cistern was filled with 21 cwts. of water, and when that was exhausted in feeding the boiler, the feed valve was closed, and the cistern was refilled with 21 cwts. more, so that the actual quantity evaporated was most accurately obtained.

Column No. 6, represents the mean temperature of the water in the lower cistern before evaporation, and was thus obtained: the temperature of the water each time the cistern was filled was taken, and again when it was nearly empty, the mean of all these temperatures is represented in column No. 6. The mean temperature in the line of Totals was obtained by multiplying each weight of water, given in column No. 5, by the corresponding temperature in column No. 6, the products being added together, and divided by the total weight of water, which gives the true mean temperature of the whole water evaporated.

Table No. II

Column No. 1, refers to the totals in Table No. 1.

Columns Nos. 2, 3, 4, 5, & 6, require no further explanation than has been already given.

Column No. 7, represents the pounds weight and decimals of a pound of water evaporated by the consumption of one pound of fuel; the water before evaporation being at the corresponding temperatures given in column No. 6.

Column No. 8, represents the cubic feet and decimals of a cubic foot of water evaporated by the consumption of 112 lb. of coal, under similar circumstances to those given in column No. 7.

Column No. 9, represents the cubic feet and decimals of a cubic foot of water, that would have been evaporated, if the temperature of the water admitted into the boiler had been equal to 212° of Fah., and is obtained thus:* The latent heat of steam was stated by Mr. Watt to be equal to 950°, the sensible heat at the boiling point is 212°, the sensible and latent heat together being equal to 1162°, but as the water to be evaporated (see experiment No. 1,) had already 80·9° of heat in it, the number of degrees of heat required to be communicated to the water to convert it into steam would be 1081·1° only, and if the temperature of the water had been 212°, it would have required only 950° of heat (equal to the latent heat) to be communicated to it to convert it into steam, hence

	Heat.		Coal.		Heat.		Coal.
As	1081·1°	:	112 lb.	: :	950°	:	98·4 lb.

Thus if the temperature of the water had been 212° Fah. before it had been admitted into the boiler, 98·4 lb. of coals would have evaporated as much water as 112 lb. of coals would have done, the temperature being 80·9, hence

Coal,		Water.		Coal.		Water.
98·4 lb.	:	13.43 cubic feet	: :	112 lb.	:	15·28 cubic feet,

in other words, 112 lb. of coal will evaporate 15·28 cubic feet of water from 212° Fah., and only 13·43 cubic feet from 80·9° Fah.

The object of column No. 9, is to show a fair comparison between all the experiments, reducing them to one standard, which is rendered necessary from the circumstance of the temperatures given in column No. 6, varying in each series of experiments.

Column No. 10, shows the amount of saving in fuel under different states of clothing, or exposure of the boiler, steam-pipes, &c., as described in column No. 11.

Table No. III.

Columns Nos. 1, & 2, require no farther explanation than has already been given.

Column No. 3, represents the weight of water passing through the cylinder, or into the steam jacket in the form of steam, in the time stated in column No. 2.

Column No. 4, represents the number of strokes made by the engine in the time stated in column No. 2, which is necessary to be recorded, that the power of the engine may be ascertained.

Column No. 5, is the pressure under which the engine worked, or the height to which the water was raised, and was obtained by noting down every 15 minutes during the time the experiments lasted, the pressure, indicated by a mercurial syphon-gauge attached to the pump, then taking the mean of the pressures so noted down, and adding to it the height from the level of the water in the engine well to the datum line of the mercurial gauge; the mean pressure in the line of totals was obtained by multiplying the figures in columns No. 4 and 5 together, and dividing by the total number of strokes, which gives the true mean of the observations made every 15 minutes.

Table No. IV.

Column No. 1 refers to the totals in Table No. 3.

---

* Vide Mr. Parke's paper on the evaporation of water from steam boilers. Transactions of the Institution of Civil Engineers, vol. 2, page 172.

Columns No. 2, 3, 4, 5, and 6, require no farther explanation than has been already given.

Column No. 7, shows the average number of strokes made by the engine per minute during the time of the experiments.

Column No. 8, shows the effective power of the engine, and is obtained by multiplying the weight of water lifted each stroke (which was equal to $1920\frac{52}{100}$) by the pressure shown in column No. 6, and by the strokes per minute shown in column No. 7, the product being the number of pounds weight raised I foot high per minute, which, divided by 33,000lb., will give the horses' power indicated in column No. 8.

Column No. 9, shows the quantity of water (in decimals of a cube foot) required per hour to pass through the cylinder and steam jacket in the form of steam to produce one horse's power, and is obtained by reducing column No. 4 to cubic feet, and dividing by the hours given in column No. 3, and again dividing the quotient by the horses' power represented in column No. 8.

Column No. 10, shows the proportional quantity of water in the form of steam required per horse's power under different states of clothing or exposure of the cylinder, &c., as described in column No. 12.

Column No. 11, shows the proportionate saving of water by clothing the cylinder as described in column No. 12.

Upon examination of the results shown in the Tables, a description of which has just been given, it will be seen in Table No. 2, that when the boiler was clothed with *one* coat of Borradaile's Patent Felt, that the evaporation was a little greater than when clothed with five coats of hop sacking. When clothed with *two* coats of felt it was not superior to *one* coat of felt, but when clothed with *three* coats, the evaporation was $1\frac{4}{10}$ per cent. greater; and when one coat of felt had been laid on the top of the flues, on the flag stones round the boiler, the evaporation was increased $3\frac{9}{10}$ per cent., and when the boiler was clothed with four coats, and the top of the flues with two coats, the evaporation was increased $\frac{5}{10}$ per cent. only; from this it would appear that to produce a considerable saving in fuel, it is necessary to have at least three coats of felt, and that the top flues should be coated with at least one coat of felt.

Upon examination of Table No. 4, it will be seen, that to obtain the greatest effect of saving from casing with Patent Felt, that not only the steam-jacket and steam-pipes should be clothed, but also the cylinder-cover, and steam-nozzle. The result of these experiments, which an examination of the tables will prove to have been carried on upon a large scale, each trial being continued for several days, shows that by properly clothing the boilers, steam-pipes, and flues, with Borradaile's Patent Felt, a saving of fuel of $10\frac{8}{10}$ per cent. may be effected; and by properly clothing the cylinder-steam-jacket, steam-pipes, nozzle and cylinder-cover, a saving of 15 per cent. is effected in the quantity of water converted into steam to produce a given effect: and consequently, the combined result is equal to a saving of fuel of $25\frac{8}{10}$ per cent.

Although the saving in fuel effected may be considered as the greatest advantage in using the Felt, yet there are others of no slight importance which should be noticed.

1st. The saving in the repairs of the boilers; supposing two boilers equally well made, of equally good materials, under which the same quality of coals is burnt, and in which the same quality of water is used, it is very certain that the wear and tear of the two boilers will be in proportion to the quantity of fuel burnt under them; now if the same effect can be produced by using 25 per cent. less fuel under one than under the other, the wear and tear will be 25 per cent. less in one than in the other; now although the actual amount of saving cannot be estimated, as it must depend upon the quality of materials and workmanship employed, which varies in almost every boiler, nevertheless, that it is a matter of importance will strike every one who has had to do with repairs of boilers.

2ndly. In steam-vessels it must be remembered that a reduction in the weight of coals is equivalent to an increase of tonnage, or in other words, supposing a foreign vessel whose cylinders, steam-pipes, and boilers are unclothed, carries in the course of twelve months 4000 tons of coals as fuel for the engines, a reduction in the fuel of 25 per cent. will enable them to carry 1000 tons extra weight of cargo.

3rd. Reduction in the cost of labour in working the engines, especially on board steam-boats. Upon this point it is not necessary to say more than that, by reducing the quantity of fuel to be used, and reducing the temperature of the engine room, and stoke hole, the labour of the engine men and stokers will be considerably less, and it is very evident a considerable saving may be made in this item of expenditure.

4th. If judiciously applied, the felt will prove a great safe-guard against fire, as it will be seen, by reference to Mr. Aikin's experiments, an account of which is appended to this report, that it may be exposed to a temperature of 400° Fahr. without being affected.

EXPENCE OF CLOTHING.

This, of course, must vary according to the size of the engine and boilers, whether land or marine, engines, &c. &c.; the cost, however, of clothing the engine upon which the trial was made, and *two* boilers with four coats of felt, the engine work covered with green baize oil-cloth, and the boiler with canvas, as herein-before described, was £96; the engine working 12 hours per day exposed, or not clothed, would consume 1100 tons of small Newcastle coals per annum, which, at 17*s*. per ton would be equal to £935; 25 per cent. saving on this would be £233 15*s*. or 251 per cent. profit upon the outlay of £96.

DURABILITY OF THE FELT.

It has been the general practice to coat the boilers, pipes, and cylinders with a mixture of white lead, alum, Paris white, and linseed oil, before the first coat of felt is laid upon it, with the intention of preventing the felt from being scorched from direct contact with the heated metal; and it has been said that the fire which occurred in the Great Western steam ship when in the Thames, on her first voyage, was occasioned by the oil in this composition catching fire; to ascertain how far the use of this paint was necessary, and also what heat the felt would bear without being injuriously affected, I requested Mr. Arthur Aikin to try some experiments, and favour me with his opinion on this matter, and beg to refer you to his letter, which is appended to this report, and which to me appears most satisfactory; I also beg to draw your attention to his valuable suggestion of a new mixture to be applied in the place of that used at present in places where it may be found necessary, as being much more efficacious. With a view of showing the saving which may be effected by the use of the patent felt, I have calculated the Table No. V., shewing the saving in annual expence in proportion to the consumption of coals per annum, and the price per ton.

In conclusion, I beg leave to say that I had not, before I tried these experiments, an idea that the saving would be so great as it proves to be; the experiments have been, however, conducted with so much care, each series has been continued for so long a time, and the coals used having been from the same cargo, that I have not the slightest doubt any person clothing their boilers and engines in the *same manner, and to the same extent hereinbefore described*, will at once effect 25 per cent. saving in fuel, or in case of a boiler and steam pipes alone where an engine is not used, a saving of 10 per cent.

THOMAS WICKSTEED,
Civil Engineer.

Old Ford, August 14th, 1840.

REPORT OF ARTHUR AIKIN, ESQ., F.L.S., F.G.S., &c.

MY DEAR SIR—You inform me that it is customary to cover the outside of steam boilers with a paint composed of lead, oil and alum previous to applying the coating of felt. This you say is done with the intention of preventing the felt from being scorched by direct contact with the heated metal of the boiler. You require my opidion if it is necessary to interpose any substance in order to avoid injury to the felt, and likewiae inform me that in one instance a fire was said to have originated from the oil paint becoming overheated.

With the view of answering your inquiries in a satisfactory manner, my first object was to ascertain the utmost degree of heat which felt is capable of bearing without injury. For this purpose I put several pounds of mercury in an iron basin, and then placed another smaller basin on the mercury—in the smaller basin I put a layer of felt, and applied pressure to the upper surface of the felt sufficient to force the bottom of the iron basin in which it was contained, so deep in the mercury that there was only about half an inch of mercury between the two basins. A pot of burning charcoal was then placed below the larger basin, and a mercurial thermometer graduated to 600 Fah. was dipped from time to time in the mercury to ascertain the temperature. When the heat had risen to 300 Fah. a small piece of felt was immersed in the mercury between the two basins, and was withdrawn occasionally as the heat increased, in order to observe the effect produced on it. Up to the temperature of 440° or 450°, the felt appeared to suffer no injury, the colour remaining unaltered; but from 450° to 480° the colour first became deeper, the elasticity of the fibre was destroyed, it then became nearly black, and at the same time gave out the odour of burning hair. The hot charcoal was then removed, and on examining the felt which was in the small basin, it gave out, while warm, a burnt odour, and the surface in contact with the iron had become of a dark brown colour, as you may see in the specimen which accompanies this report. I consider therefore the heat of 440 Fah. as the highest to which felt can be exposed without injury, even for a short time (for my experiment did not continue above an hour), and if the heat were continued for several days, it probably ought not to exceed 400 Fah. If therefore the external heat of a steam boiler is liable to rise to 400 Fah., it would be prudent to interpose some substance between the surface of the boiler and the felt, but for this purpose oil paint with a basis of litharge, red lead or white lead is not to be recommended; for the oxides of lead are, all of them, especially the second, very easy of decomposition when mixed with oil and heated. While decomposing, that is, while the oxygen of the lead is combining with the combustible ingredients of the oil, a considerable increase of heat is excited, and this may, under favourable circumstances, be so great as to produce actual combustion of the oil.

In making experiments with the intention of discovering a composition free from the objections to oil paint, and at the same time cheap, the following occurred to me, and I find on trial that it adheres perfectly well when dry to the surface of iron, and will bear a heat of between 500° and 600° without material injury; it also retards considerably the efflux of heat, and will therefore, I think, be found a very good protection for the felt. It is made as follows:—

Take very stiff clay and sand (that of a bright yellow colour is best), dry them separately at a heat not much exceeding that of boiling water; reduce them to powder and pass them through a moderately fine sieve. Of the sand take four measures, and of the clay two measures, and mix them well; then add one measure of linseed meal, and one measure of horse dung, mixing them with the other ingredients as accurately as possible. Pour into any convenient vessel boiling hot water, and shake into it the above composition by small quantities at a time, observing that the last added quantity is thoroughly soaked before another is put in; there will thus be obtained a slippery semi-gelatinous mass which is best applied to the surface of the boiler by means of a trowel.

The first layer should be very thin, and care must be taken that it does not slip down while wet, when it has become dry it will adhere firmly, and if its surface is left rather rough, the second layer may be applied without any hazard of its slipping.

A. Aikin.

7, Bloomsbury Square, Aug. 6, 1840.

TABLE No. I.

Detail of Coals consumed and water evaporated in the course of 72 experiments, during which there were 4275 bushels of coals consumed, 1287 tons and 8 cwts. of water evaporated.

1	2	3	4	5	6	7
Reference to Table No. II.	Number of Experiments.	Duration of Experiments.	Quantity of Coals consumed.	Weight of Water Evaporated	Mean Temp. of Water before evaporation.	State of Boiler.
		Hours.	Bushls.	Cwts.	Degs. of Fahren.	
	1	10½	65	357	74·8	Boiler, steam pipes and flues exposed or not clothed.
	1	10½	63	357	76·6	
	1	10½	63	357	79·0	
	1	10½	64	357	83·6	
	1	10¼	62	354	85·2	
	1	10½	64	360	86·3	
I.	6	62¾	381	2142	80·9	
	1	10½	63	366	86·3	Boiler and steam pipes clothed with 3 coats of hop sacking.
	1	10½	63	376	86·7	
	1	10½	63	362	85·0	
	1	10½	62	357	85·1	
	1	10½	63	369	84·9	
	1	10½	63	364	84·7	
	1	16¾	64	375	85·6	
	1	10¾	62	360	85·1	
	1	10¾	61	356	86·3	
	1	10¾	63	375	87·0	
	1	10¾	63	376	88·0	
II.	11	116¾	690	4036	85·8	
	1	10¾	60	346	89·0	Boiler and steam pipes clothed with 5 coats of hop sacking.
	1	10¾	61	383	89·0	
	1	10¾	60	368	91·0	
	1	10¼	57	353	94·2	
	1	10¾	61	341	92·6	
	1	10¾	62	387	99·3	
	1	11	62	361	97·7	
	1	11	64	378	98·6	
	1	11¼	65	389	97·5	
	1	11¼	63	387	97·8	
	1	11¼	65	387	96·8	
	1	11¼	65	375	95·8	
	1	11¼	64	373	93·5	
III.	13	142¼	809	4828	94·9	
	1	11¼	64	382	95·0	Boiler and steam pipes clothed with 1 coat of Borradaile's patent felt.
	1	11¼	65	383	95·7	
	1	11¼	63	380	94·3	
	1	11¼	63	380	93·4	
IV.	4	45	255	1525	94·6	
	1	11¼	61	375	92·4	Boiler and steam pipes clothed with 2 coats of Borradaile's patent felt.
	1	11¼	62	368	92·2	
	1	11¼	62	368	91·2	
	1	10½	59	344	87·0	
	1	10¾	54	319	87·4	
	1	11¼	53	314	85·7	
V.	6	66¼	351	2088	89·5	
	1	11¼	54	318	83·5	Boiler and steam pipes clothed with 3 coats of Borradaile's patent felt.
	1	11¼	52	312	83·5	
	1	11¼	51	305	85·4	
	1	11¼	52	307	85·0	
	1	11¼	53	316	86·3	
	1	11¼	52	314	87·5	
	1	11¼	51	313	90·0	
	1	11¼	50	312	90·7	
VI.	8	90	415	2497	86·4	
	1	11¾	55	341	94·0	Boiler and steam pipes clothed with 3 coats and flues round boiler, with 1 coat of Borradaile's patent felt.
	1	11¾	56	355	92·6	
	1	11¾	55	347	90·4	
	1	11¾	54	339	90·4	
	1	11¼	54	337	95·3	
	1	11¾	54	345	94·8	
	1	12	53	339	93·3	
	1	12	54	338	92·0	
	1	12	54	336	93·2	
	1	11½	55	361	95·3	
	1	14½	72	439	96·5	
	1	11¾	57	361	95·2	
	1	11¾	59	370	95·0	
	1	11¾	58	371	93·4	
	1	11¾	60	380	94·2	
	1	11¾	63	393	94·4	
	1	11¾	63	376	95·0	
VII.	17	202½	976	6128	93·8	
	1	11¾	58	364	92·0	Boiler and steam pipes clothed with 4 coats and top of flues with 2 coats of Borradaile's patent felt.
	1	11¾	58	366	93·3	
	1	11¾	57	359	95·3	
	1	11¾	57	359	92·3	
	1	11¾	56	354	90·3	
	1	11¾	56	351	92·3	
	1	11¾	56	351	88·4	
VIII.	7	82¼	398	2504	92·0	

TABLE No. II.

A summary of experiments detailed in Table I., and also showing the lbs. of water evaporated per lb. of coals, and cubic feet evaporated per 112 lbs. of coals from 212° Fahrenheit.

1	2	3	4	5	6	7	8	9	10	11
Reference to Table No.	Number of Experiments.	Duration of Experiments.	Quantity of coals consumed.	Weight of water evaporated.	Mean temperature of water before evaporation.	Water evaporated by 1 lb. of coals.	Cubit feet of water evaporated by 112 lbs. of coals.	Cubic feet of water that would have been evaporated by 112 lbs. of coals, if the initial temperature had been 212°.	Proportionate saving by the increase of evaporation 15·28 cubic feet being = 100.	State of Boiler.
		Hours.	Bushels.	Cwts.	Fahrenheit	Lbs.	Cubic feet.			
I.	6	62¾	381	2142	80·9°	7·496	13·43	15·28	100	Boiler steam pipes and flues exposed, or not clothed.
II.	11	116¾	690	4036	85·8°	7·799	13·97	15·83	103·6	Boiler and steam pipes clothed with 3 coats of hop sacking.
III.	13	142¼	809	4828	94·0°	7·957	14·25	16·00	104·7	Boiler and steam pipes clothed with 5 coats of hop sacking.
IV.	4	45	255	1525	94·6°	7·973	14·28	16·04	105	Boiler and steam pipes clothed with 1 coat of Borradaile's patent felt.
V.	6	66¼	351	2088	89·5°	7·931	14·21	16·04	105	Boiler and steam pipes clothed with 2 coats of Borradaile's patent felt.
VI.	8	90	415	2497	86·4°	8·022	14·37	16·27	106·4	Boiler and steam pipes clothed with 3 coats of Borradaile's patent felt.
VII.	17	202¼	976	6128	93·8°	8·371	15·00	16·86	110·3	Boiler and steam pipes clothed with 3 coats and flues round boiler with 1 coat of patent felt.
VIII.	7	82¼	398	2504	92·0°	8·388	15·03	16·93	110·8	Boiler and steam pipes clothed with 4 coats and top of flues with 2 coats of Borradaile's patent felt.

TABLE No. IV.

A summary of experiments detailed in Table No. III., and also showing the strokes per minute, power of engine, and water consumed per hour per horse power under different states of clothing.

1	2	3	4	5	6	7	8	9	10	11	
Reference to Table No. III.	Number of experiments.	Duration of experiments.	Weight of water evaporated.	Strokes made by engine.	Height of column of water under which the engine worked.	Number of strokes made by engine per minute.	Effective power of engine.	Water evaporated per hour to produce one horse power.	Proportional diminution in the water required per horse's power per hour ·828 of a cubic foot being = 115.	Saving effected by casing the cylinder &c.	State of Cylinder.
		Hours.	Cwts.		Feet.		horsepower	Cubic feet.			
I.	6	73	2282	48381	105·2	11·04	67·59	.828	115	100	Cylinder, steam jacket, and steam pipes exposed or not covered.
II.	7	82¼	2504	55555	105·8	11·25	69·26	·787	109·3	105·7	Cylinder, steam jacket, and steam pipes clothed with 4 coats of Borradaile's patent felt.
III.	5	58¾	1676	39602	106·0	11·23	69·27	·737	102·3	112·8	Cylinder, steam jacket, and steam pipes clothed with 4 coats, and cylinder cover with one coat of Borradaile's patent felt.
IV.	4	47	1339	31818	106·7	11·28	70·04	·728	101·1	113·9	Cylinder, steam jacket, and steam pipes, cylinder cover and steam nozzle clothed with 4 coats of patent felt.
V.	5	58¼	1668	39901	107·2	11·36	70·87	·720	100	115	Cylinder, steam jacket, and steam pipes, and cylinder cover and steam nozzle clothed with four coats of patent felt covered with green baize oil cloth.

design, the execution of which will cost £700 or £750 more than the sum mentioned in the instructions given to the architects.

Your correspondent K. P. S. says, "having selected the design, the subscribers proceeded to receive tenders for its execution; and it having been whispered that the estimates of the builders greatly exceeded the stipulated sum, the result was—not that the subscribers rejected the design and chose another—but that the tenders were returned to the builders unopened, and the designs referred back to the architect, for the purpose of being altered, so as to bring it within the means of the subscribers."

This statement is totally at variance with the truth. The first tenders were not returned to the builders, and the design was not referred back to the architect for the reason stated. This course was taken solely on account of an objection to the mode of constructing the roof, made by the Incorporated Society for building Churches; and the objection of the Society was communicated to the subscribers after the first tenders were received.

Your correspondent proceeds, "how the subscribers have fulfilled the conditions they dictated, may be seen by the following statement: The accepted tender amounted to £3550 in round numbers."

This Sir, is not in accordance with the fact: the sum for which the Church is to be completed is £3,353.

K. P. S. continues, "in addition to this, extra foundations, to the amount of £150 to £200, were found to be necessary, not in consequence of any unforeseen difficulty, such as might arise from the nature of the soil, &c."

The fact, Sir, is, that the "extra foundations were required by the nature of the soil." It was necessary to remove a very considerable body of earth for every part of the foundations, and in the site of the tower, the ground was excavated to the depth of 13 feet; and the foundations was made of the best concrete, comprised of lime and gravel, brought from a distance of nearly 3 miles.

"The cost of the building," continues K. P. S., "is therefore to be from £3,700 to £3,750."

This inference is very far from the truth. The sum for which the Church is be completed is, as I have before observed, £3,353. But from this gross sum is to be deducted the amounts of the drawback on the duties upon the customable and exciseable materials used in the building, as was expressly stated in the directions to the architects in the letter dated Nov. 30, 1839. This drawback is estimated at £350.

The cost of the Church, therefore, will amount as nearly as possible to £3,000, the sum which the subscribers have always stated that they intended to expend.

K. P. S. continues, "neither plastering nor painting are included in the contract."

This is opposed to the fact. The walls indeed are not to be plastered, but all the plastering which the subscribers think fit to do, *is included* in the contract; and so also is the painting.

K. P. S. continues, "instead of 650 sittings in pews on the ground floor, there are but 360; 180 more in open seats, and the remainder on benches."

The subscribers have thought fit to substitute for pews of three different widths, seats of uniform width throughout the body of the Church, some close pews, some open pews, and along the middle aisle, benches.

K. P. S. continues, "instead of stone quoins, there is not an atom of stone in the building but what may be indispensable."

This statement also is opposed to truth. There is much more stone in the building than would have been indispensable in making stone quoins: all the weatherings are of stone, as are also the string courses.

K. P. S. continues, "the window jambs, &c., are of moulded brick, not gauged brick, but bricks from the kiln, with good ⅜ joints between them. The side roofs are to be covered with zinc."

I have only to observe that there was nothing in the instructions to the architects which rendered it improper to build in the way that has been adopted.

K. P. S. continues, "the side walls are 2½ bricks thick, but, to save materials, are built hollow, the construction of the rest of the building being in strict keeping."

The inference which an incautious reader might be induced to adopt from this statement, would perhaps be this—that the walls are hollow throughout. Nothing could be further from the fact. There are no chambers, but in those parts of the walls where there is little weight to be supported. In the latter part of the last clause, K. P. S. has been more guarded and prudent than in the rest of his letter, because it is only an insinuation, and therefore does not admit of any direct contradiction.

K. P. S. continues, "whether all this is quite acting up either to the letter or the spirit of the instructions of the Incorporated Society, may admit of a doubt at least."

The doubt, Sir, is soon resolved; for the subscribers have the approbation of the Incorporated Society testified by the signature of their secretary upon the plans; and indeed the quantity of materials used in the walls is greater than is required by those approved plans.

"It will admit of a doubt," continues K. P. S., "whether a building with bare walls of ordinary brick, and fittings of naked deal inside, can be exactly said to maintain an ecclesiastical character."

How far the New Church can be said to maintain an ecclesiastical character, must be a matter of taste of opinion; but it is believed that no one has seen the designs of Mr. Ranger, the architect, without admiration of their beauty and their perfect adaptation to the purposes for which the building is required; and that no one has seen the building itself, so far as it has already been executed, without approbation of the mode in which the work is done.

So great a discordance between the statements of K. P. S. and the facts of the case, the subscribers conceive can only have arisen from this cause—that K. P. S. has seen neither the contract nor the building, and therefore neither knows what has been done, nor what it is intended to do. He might have seen both by applying either to me, or to the clerk of the works, and he is quite welcome to do so whenever he pleases.

I am, Sir, your obedient servant,
J. SPARKE, *Hon. Sec.*

Bury St. Edmund's, Oct. 19, 1840.

RANGELEY'S SAFETY ROTATION RAILWAY.

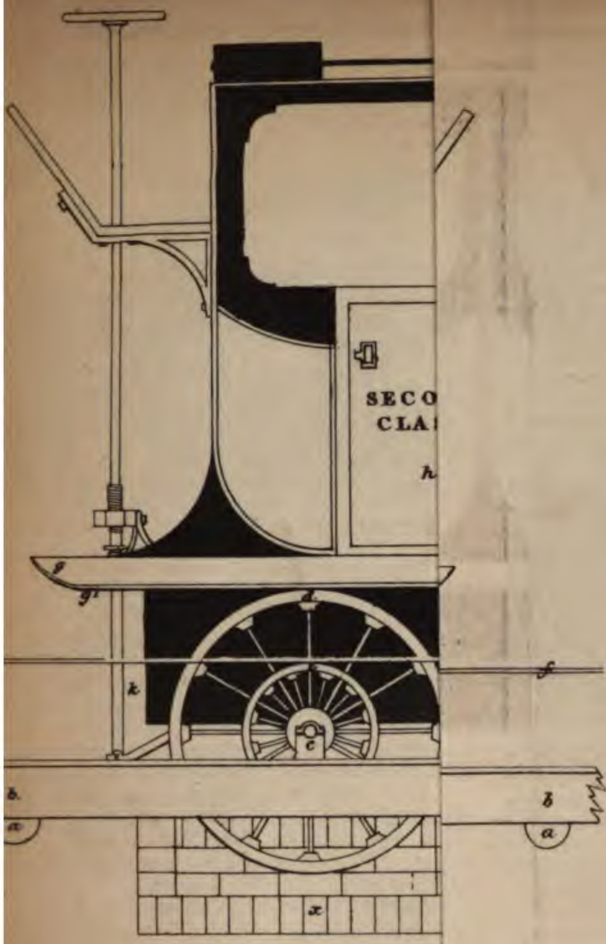
(With an Engraving, Plate XVII.*)*

IN the September number of our Journal we gave a short description of this invention, and also in the present number will be found an abstract of a paper read at the British Association, but as we thought many of our readers might feel interested in the proposed novel mode of transit, we have prepared the accompanying plate illustrative of the subject, and which, with the following description, will fully enable our readers to judge of its practicability.

This system consists in the adoption of two parallel lines of fixed wheels along the proposed road, at any moderate gauge, and at a short distance longitudinally from centre to centre of each wheel. These are termed the bearing wheels, which, together with a double pulley, are cast or keyed on to a common axle marked *d* and *e* in the engraving. The axles of these bearing wheels and pullies work in plummer blocks *c*, fixed on to cast-iron beds or bearing frames *b*, which are proposed to be in 12 feet lengths, and secured to three wood sleepers and to each other in the way shown in fig. 3; but to prevent elevating these iron beds much above the surface of the ground, a chamber of masonry or iron is necessary to enable the bearing wheels to revolve free from obstruction. Over every pulley is passed an endless band working into the adjoining pulley each way, so that for any distance that the road may be carried there would be an equal distance of band, but in a series of lengths, equal to the distance from each other, of pulley from pulley. Having proceeded so far in our description, we will now explain the method of action:—A steam engine, water wheel, or other motive power being connected with the pullies at each end of such a series of wheels, and motion given thereto, it would in a short time communicate it throughout; and each wheel revolving in the same direction, it is evident that any body placed on the upper periphery of the wheels, so that it could not quit the track, would be in a short time carried from one end to the other, and in greater or less time according to the greater or less rapidity with which the wheels revolve.

By referring to figs. 1 and 2, it will be perceived that the carriage is without wheels, and in fact a kind of sledge; an iron rail is fixed in the underside of the bearing frame to prevent the rapid wear which would otherwise take place from the friction of the wheels in progressing the carriage.

The safety of this mode of transit arises from a considerable portion of the carriage depending between the wheels, and which is termed the baggage box *k*, and the steady motion of the carriage will in a great measure depend on the load which may be stowed therein. To prevent lateral friction against the wheels on beds, guide wheels are fixed at each end of the baggage box, which will prevent the carriage at any time from quitting the track, and also assist in its passage round corners; a break at each end (for regulating the speed, or stopping the carriage, by slightly raising it, and of course diminishing the friction or bite of the wheels on the carriage), is shown in figs. 1 and 2.


SECO
CLA
h
g
g'
d
f
k
e
b
b
a
a
x

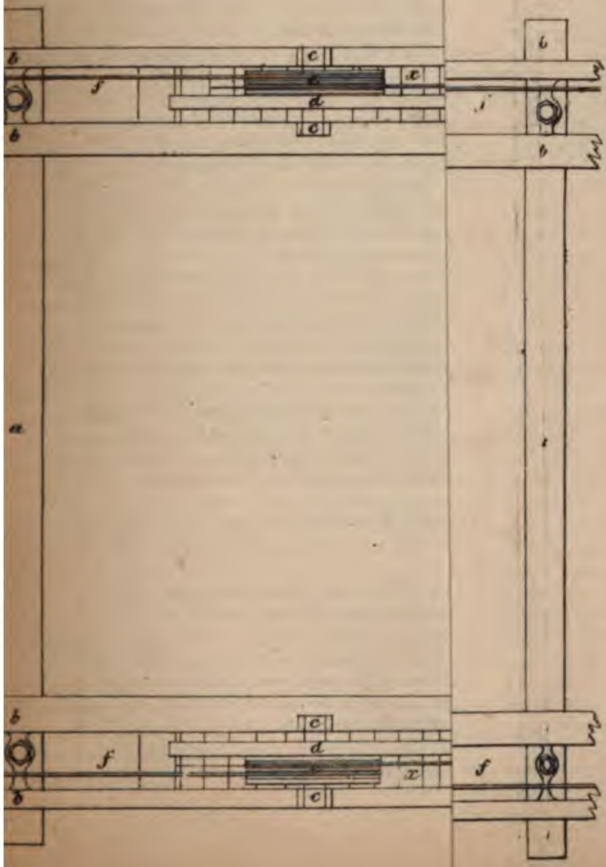
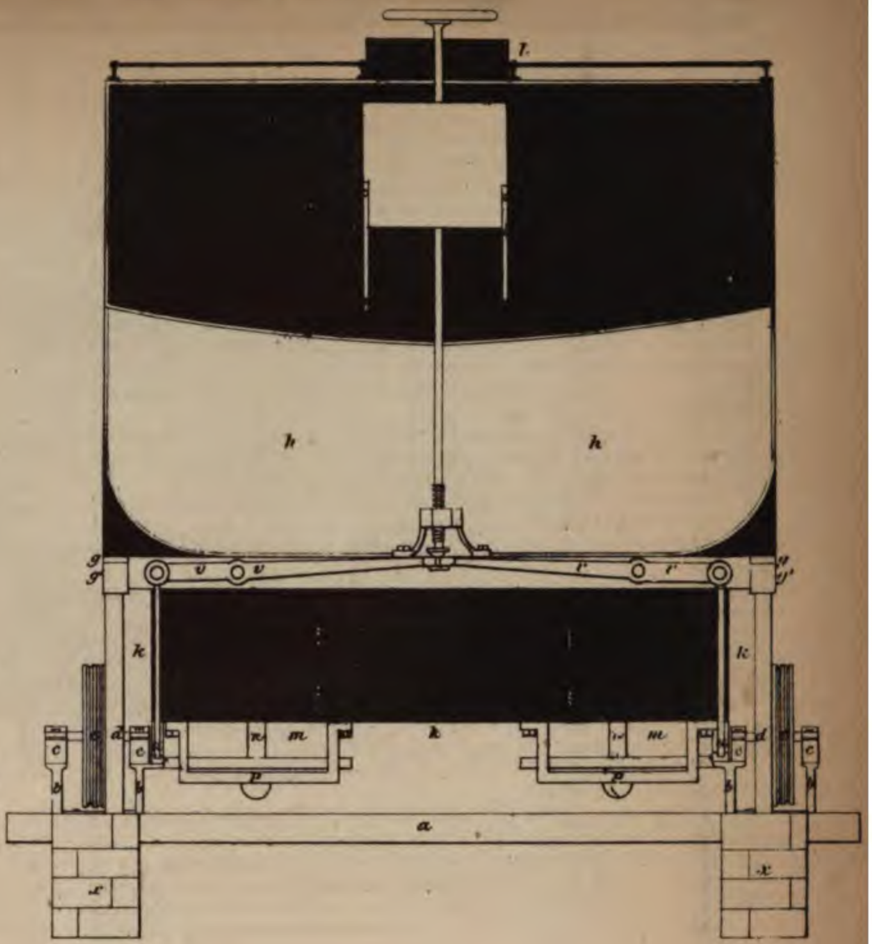

b
c
e
x
d
c
b
f
i
b
a
i
b
c
d
f
x
c
b
f

Fig. 2.


l
h
h
g
g'
v
v
r
r
g
g'
k
k
c
d
n
m
k
m
d
c
b
p
p
b
a
x
x

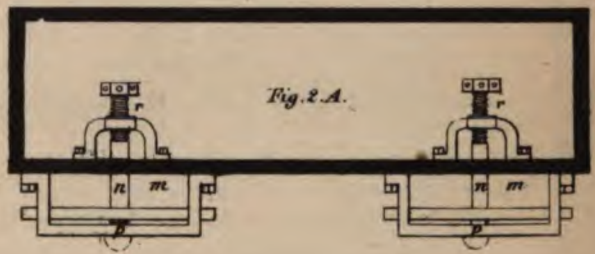


Fig. 2.A.
r
r
n
m
n
m
p
p

Fig. 4

k

design, the execution of which will cost £700 or £750 more than the sum mentioned in the instructions given to the architects.

Your correspondent K. P. S. says, "having selected the design, the subscribers proceeded to receive tenders for its execution; and it having been whispered that the estimates of the builders greatly exceeded the stipulated sum, the result was—not that the subscribers rejected the design and chose another—but that the tenders were returned to the builders unopened, and the designs referred back to the architect, for the purpose of being altered, so as to bring it within the means of the subscribers."

This statement is totally at variance with the truth. The first tenders were not returned to the builders, and the design was not referred back to the architect for the reason stated. This course was taken solely on account of an objection to the mode of constructing the roof, made by the Incorporated Society for building Churches; and the objection of the Society was communicated to the subscribers after the first tenders were received.

Your correspondent proceeds, "how the subscribers have fulfilled the conditions they dictated, may be seen by the following statement: The accepted tender amounted to £3550 in round numbers."

This Sir, is not in accordance with the fact: the sum for which the Church is to be completed is £3,353.

K. P. S. continues, "in addition to this, extra foundations, to the amount of £150 to £200, were found to be necessary, not in consequence of any unforeseen difficulty, such as might arise from the nature of the soil, &c."

The fact, Sir, is, that the "extra foundations were required by the nature of the soil." It was necessary to remove a very considerable body of earth for every part of the foundations, and in the site of the tower, the ground was excavated to the depth of 13 feet; and the foundations was made of the best concrete, comprised of lime and gravel, brought from a distance of nearly 3 miles.

"The cost of the building," continues K. P. S., "is therefore to be from £3,700 to £3,750."

This inference is very far from the truth. The sum for which the Church is be completed is, as I have before observed, £3,353. But from this gross sum is to be deducted the amounts of the drawback on the duties upon the customable and exciseable materials used in the building, as was expressly stated in the directions to the architects in the letter dated Nov. 30, 1839. This drawback is estimated at £350.

The cost of the Church, therefore, will amount as nearly as possible to £3,000, the sum which the subscribers have always stated that they intended to expend.

K. P. S. continues, "neither plastering nor painting are included in the contract."

This is opposed to the fact. The walls indeed are not to be plastered, but all the plastering which the subscribers think fit to do, *is included* in the contract; and so also is the painting.

K. P. S. continues, "instead of 650 sittings in pews on the ground floor, there are but 360; 180 more in open seats, and the remainder on benches."

The subscribers have thought fit to substitute for pews of three different widths, seats of uniform width throughout the body of the Church, some close pews, some open pews, and along the middle aisle, benches.

K. P. S. continues, "instead of stone quoins, there is not an atom of stone in the building but what may be indispensable."

This statement also is opposed to truth. There is much more stone in the building than would have been indispensable in making stone quoins: all the weatherings are of stone, as are also the string courses.

K. P. S. continues, "the window jambs, &c., are of moulded brick, not gauged brick, but bricks from the kiln, with good ⅜ joints between them. The side roofs are to be covered with zinc."

I have only to observe that there was nothing in the instructions to the architects which rendered it improper to build in the way that has been adopted.

K. P. S. continues, "the side walls are 2½ bricks thick, but, to save materials, are built hollow, the construction of the rest of the building being in strict keeping."

The inference which an incautious reader might be induced to adopt from this statement, would perhaps be this—that the walls are hollow throughout. Nothing could be further from the fact. There are no chambers, but in those parts of the walls where there is little weight to be supported. In the latter part of the last clause, K. P. S. has been more guarded and prudent than in the rest of his letter, because it is only an insinuation, and therefore does not admit of any direct contradiction.

K. P. S. continues, "whether all this is quite acting up either to the letter or the spirit of the instructions of the Incorporated Society, may admit of a doubt at least."

The doubt, Sir, is soon resolved; for the subscribers have the approbation of the Incorporated Society testified by the signature of their secretary upon the plans; and indeed the quantity of materials used in the walls is greater than is required by those approved plans.

"It will admit of a doubt," continues K. P. S., "whether a building with bare walls of ordinary brick, and fittings of naked deal inside, can be exactly said to maintain an ecclesiastical character."

How far the New Church can be said to maintain an ecclesiastical character, must be a matter of taste of opinion; but it is believed that no one has seen the designs of Mr. Ranger, the architect, without admiration of their beauty and their perfect adaptation to the purposes for which the building is required; and that no one has seen the building itself, so far as it has already been executed, without approbation of the mode in which the work is done.

So great a discordance between the statements of K. P. S. and the facts of the case, the subscribers conceive can only have arisen from this cause—that K. P. S. has seen neither the contract nor the building, and therefore neither knows what has been done, nor what it is intended to do. He might have seen both by applying either to me, or to the clerk of the works, and he is quite welcome to do so whenever he pleases.

I am, Sir, your obedient servant,
J. SPARKE, *Hon. Sec.*

Bury St. Edmund's, Oct. 19, 1840.

RANGELEY'S SAFETY ROTATION RAILWAY.

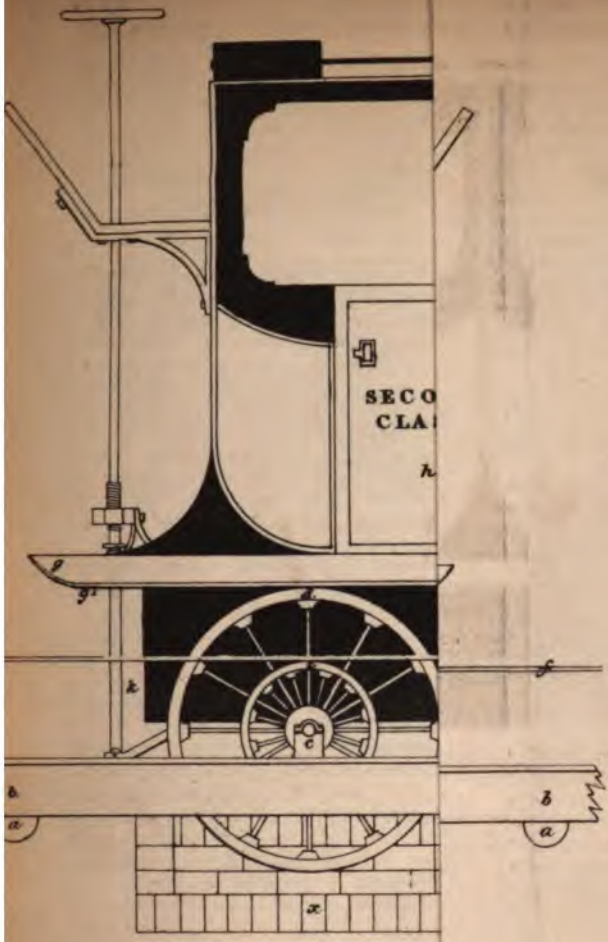
(With an Engraving, Plate XVII.*)*

IN the September number of our Journal we gave a short description of this invention, and also in the present number will be found an abstract of a paper read at the British Association, but as we thought many of our readers might feel interested in the proposed novel mode of transit, we have prepared the accompanying plate illustrative of the subject, and which, with the following description, will fully enable our readers to judge of its practicability.

This system consists in the adoption of two parallel lines of fixed wheels along the proposed road, at any moderate gauge, and at a short distance longitudinally from centre to centre of each wheel. These are termed the bearing wheels, which, together with a double pulley, are cast or keyed on to a common axle marked *d* and *e* in the engraving. The axles of these bearing wheels and pullies work in plummer blocks *c*, fixed on to cast-iron beds or bearing frames *b*, which are proposed to be in 12 feet lengths, and secured to three wood sleepers and to each other in the way shown in fig. 3; but to prevent elevating these iron beds much above the surface of the ground, a chamber of masonry or iron is necessary to enable the bearing wheels to revolve free from obstruction. Over every pulley is passed an endless band working into the adjoining pulley each way, so that for any distance that the road may be carried there would be an equal distance of band, but in a series of lengths, equal to the distance from each other, of pulley from pulley. Having proceeded so far in our description, we will now explain the method of action:—A steam engine, water wheel, or other motive power being connected with the pullies at each end of such a series of wheels, and motion given thereto, it would in a short time communicate it throughout; and each wheel revolving in the same direction, it is evident that any body placed on the upper periphery of the wheels, so that it could not quit the track, would be in a short time carried from one end to the other, and in greater or less time according to the greater or less rapidity with which the wheels revolve.

By referring to figs. 1 and 2, it will be perceived that the carriage is without wheels, and in fact a kind of sledge; an iron rail is fixed in the underside of the bearing frame to prevent the rapid wear which would otherwise take place from the friction of the wheels in progressing the carriage.

The safety of this mode of transit arises from a considerable portion of the carriage depending between the wheels, and which is termed the baggage box *k*, and the steady motion of the carriage will in a great measure depend on the load which may be stowed therein. To prevent lateral friction against the wheels on beds, guide wheels are fixed at each end of the baggage box, which will prevent the carriage at any time from quitting the track, and also assist in its passage round corners; a break at each end (for regulating the speed, or stopping the carriage, by slightly raising it, and of course diminishing the friction or bite of the wheels on the carriage), is shown in figs. 1 and 2.


SECO
CLA
h
g
g'
d
k
f
c
b
b
a
a
x

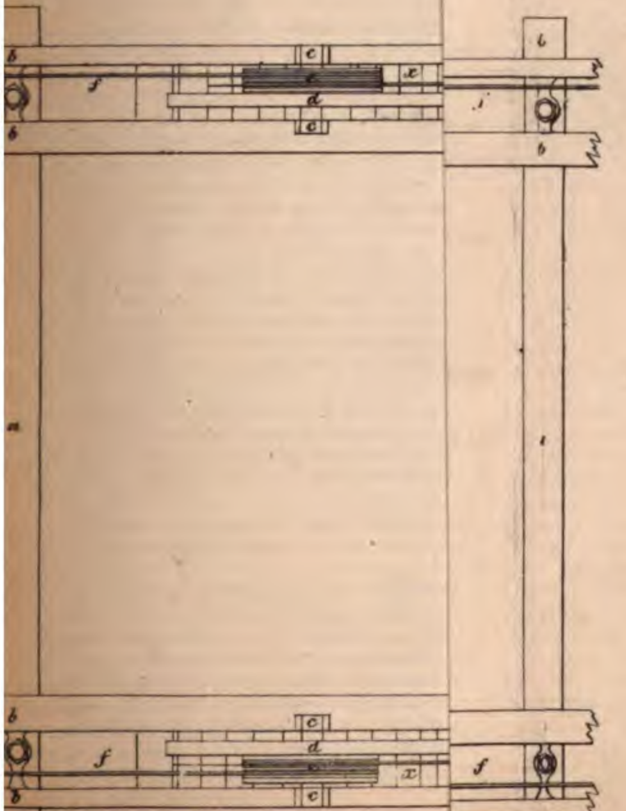
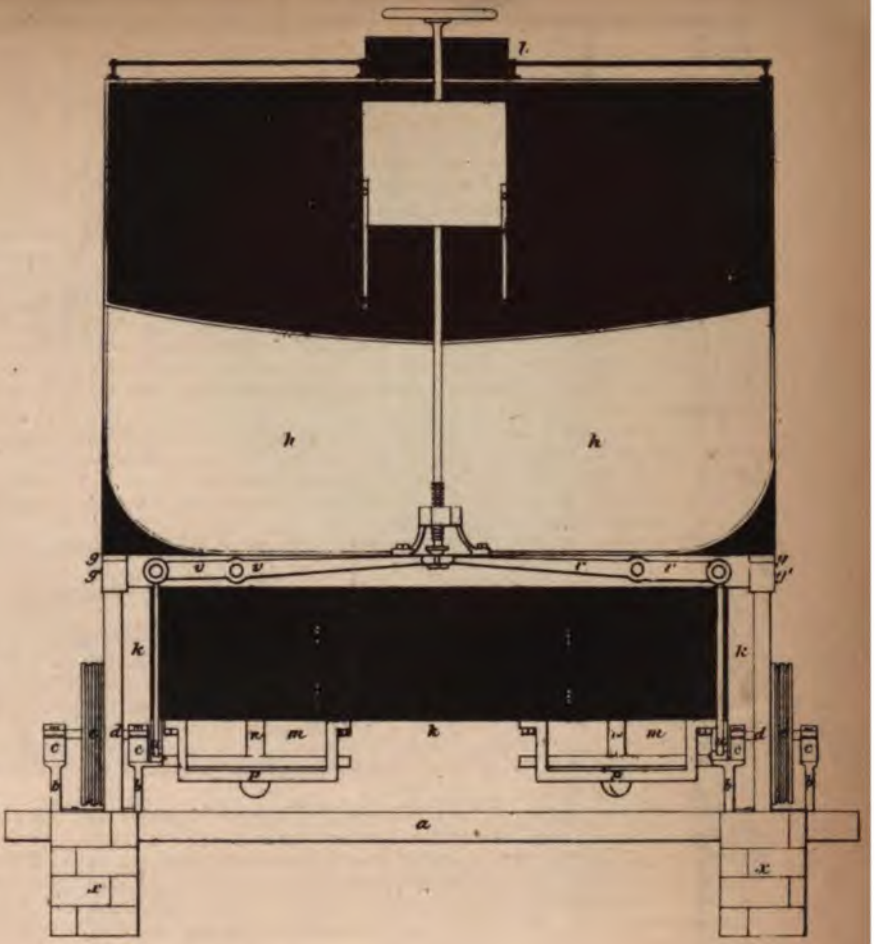

b
c
f
e
x
d
b
c
b
b
i
a
i
b
c
d
f
e
x
f
b
c

Fig. 2.


l
h
h
g
g'
v
v
r
r
k
k
k
d
c
e
n
m
m
p
p
b
a
x
x

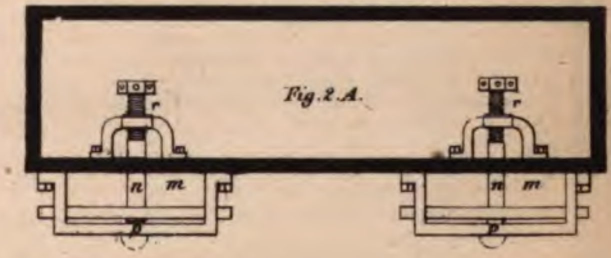
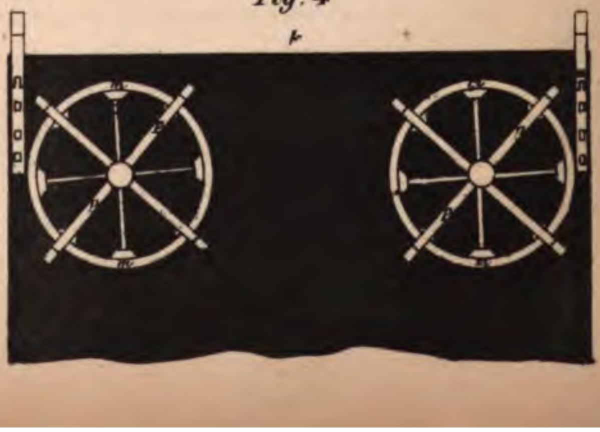


Fig. 2.A.
r
r
n
m
n
m
p
p

Fig. 4


k

CANDIDUS'S NOTE-BOOK.

FASCICULUS XX.

> "I must have liberty
> Withal, as large a charter as the winds,
> To blow on whom I please."

I. It is somewhat odd that those who profess so greatly to admire St. Paul's, Covent Garden, should not have cared to aim at the same kind of effect, as regards one peculiarity in it. It is almost doubtful, however, whether the circumstance alluded to has been taken into account at all, since it has never been especially pointed out, as deserving to be noted and studied. What I mean is, the projection of the pediment as seen in profile, and the bold shadows—or rather depth of shadow in the tympanum of the pediment. Perhaps I shall be told that this is a circumstance attending the peculiar kind of entablature and cornice there employed, and that consequently the same effect cannot be obtained in the pediment of a portico whose columns are of the Grecian Doric, or Ionic order. Most undoubtedly nót, if we are determined merely to copy Grecian authorities, yet not only so slavishly, but so blindly, as not to study such modifications of the originals as shall in some degree give us a tolerable equivalent for what is unscrupulously abandoned in the professed copy, however essential it may be to resemblance. There is no occasion whatever for impoverishing Grecian architecture, yet we do so continually without the slightest compunction, making naked entablatures and pediments, with scanty cornices, absolutely *starving* our buildings, yet congratulating ourselves all the while on the classicality and purity of our taste, and fancying that we are perfectly Grecian, whereas we are no better than architectural paupers, dressed up in old finery of which the trimmings and embroidery have been cut away.

II. Should future generations form their ideas of Grecian architecture from our modern English imitations, prodigious will be their wonder at the praises bestowed upon it; for they will be greatly puzzled to discover in them any of its spirit, or any adherence to its principles—aught of refined taste and artistical feeling. In his recent work on *Kunst-Sinnbilder*, Menzel makes some remarks on the ancient orders and the modern versions of them, that architects would do well to take into consideration. He condemns the recipes and prescriptions for making Doric, Ionic, &c., given by Vignola, Palladio, Serlio, Scamozzi and others, as leading only to the most servile and blind imitation of the patterns so set, and which are certainly not the very best in themselves. Of even the very best examples, too, the continual repetition not only becomes wearisome in itself, but also tends to check all invention in design,—at least as regards detail, and so far degrades the architect from an artist to a mere parrot or automaton. Yet in this as in other matters over-strictness is apt to lead to the opposite extreme of licentiousness: and those who would be shocked at the idea of any innovation in Greek detail, even though it were perfectly in accordance with Greek feeling, feel no scruple whatever in reverting for the sake of variety, to such deformities as the Italian Ionic,—which would be reckoned positively detestable after Greek, were it not, that there is precedent for it, and it is not an invention of our own. Out upon the *servum pecus* of pedants, whose dislike to originality arises from their own incapacity to originate any thing whatever, and who therefore bolster up their own imbecillity by a most convenient veneration for precedent.—In the grounds of Mr. Anderson's villa in the Regent's Park, there has lately been executed a small building, the capitals of whose columns would scandalize such *pseudo-legitimates*, for the very reason that they must charm every one whose taste is any thing better than mere prejudice. Ionic in character, though unlike any existing example, they display genuine artistical feeling, and a perfect knowledge of architectural principles with a thorough contempt for ready-made architectural patterns, and for those who make use of them. By all means, let the Institute procure a cast of that capital; and were the two Professors of Architecture to do so likewise, they might get from it something they now seem to be terribly in lack of.

III. In an article on Modern Churches, British Critic, No. LII, there are many remarks worth attending to, and among others what is there said in regard to the excessive quantity of light admitted into churches generally, in consequence of painted glass having been destroyed or removed from the windows of the older buildings, and its not being introduced into those of modern ones, notwithstanding that the apertures are made as large, and the spaces between them as narrow, as if it were intended to damp the light, and hinder the effect of rawness generally, by glazing the windows with rich material. "Nearly all our ancient churches," says the writer, "from the cathedral to the smallest oratory are now considerably *overlighted*. They are not now seen in their proper dress; but are like the face of nature in winter without leaves or flowers. Thus the interior of Salisbury Cathedral is as light as the open air; nay, in a sense, it is lighter; for out of doors, there is an infinite variety of light and shade, and still greater variety of hue; but in that building, as reformers and puritans have left it, there is no relief, no repose: with inconsiderable exception, all is one equally monotonous, shadowless, colourless medium: nothing recedes, nothing stands out. The proportions suffer; for neither height nor length are felt in the glaring mass of day-light.—The cathedral is reduced to one great airy room. The aisles are no longer depths of shade; the lofty pillars and arches no longer stand out in bold relief, bathed in copious streams of light and colour from the high clerestory windows, every stone from the vaults above to the pavement under our feet seeming instinct with life."—"Our churches having been nearly all built or altered with a view to painted glass, as soon as this essential part of their plan was destroyed, there was immediately found to be double or treble the quantity of aperture sufficient for light. In spite of bad glass, windows wholly or partially blocked up, curtains, galleries, and staircases, lofty screens, and all the other numberless accretions of the last three centuries, they are still greatly too light. The restorations of the present age, by opening windows, substituting larger panes of clear white glass, clearing away heavy screens and partitions, and lowering pew-walls, have in fact accidentally increased the evil, and rendered the glare of our churches, especially those of the later styles, quite intolerable, not only to the mental feeling, but to the bodily eye."

IV. In speaking of Vestries, the writer just quoted is of opinion there is little occasion for them in country churches. Such a place "is useful of course to the *crack* preachers of the metropolis, some of whom sit there and *comfort* themselves during the service, that they may come forth fresh as giants to the event of the day—the sermon." It is said also that Dr. Parr used to illustrate his attachment to rural psalmody, by "*smoking in the vestry* during the performance of the choir"! Considering the character of the publication in which the article appears, these remarks are somewhat freely satirical, though certainly not without foundation; for I myself have been in an exceedingly snug vestry, where there was a delightful blazing fire, and every thing vastly *comfortable* indeed, so much so that I should have mistaken it for the parson's own parlour, had not the sash windows been much higher up from the floor than they are in modern houses; which certainly did not diminish the appearance of comfort, inasmuch as it afforded comfortable assurance that there was no danger of any one's accidentally peeping in.

V. Whether I be censured or not for my last comment, the passage which I shall now quote from the same writer, is so excellent, that I shall be thanked for here introducing it.—"Mere novelty is not *originality*. Many things have never been done; some things have never been thought of, simply because they are unnatural and out of the way. *True originality* is a power of invention or discovery; but whether employed in the regions of science or of poetry," (or of art) "it only discovers or invents what is, in some sense, natural and true. It does not so much *make* new ideas, as *find* what have escaped the minds of others. It conceives ideas which strike us at once as having a sort of self-evident propriety and beauty. Its creations are at the same time like and unlike what we know already,—like, in that they accord with our existent taste and notions;—unlike, in that they seem each to have an individual essence."—This last expression, indeed, is not altogether a happy one: perhaps it would be better to say—unlike, in that some new modification is presented to us, for which there is no actual precedent, but which recommends itself so strongly, and withal appears so obvious that we wonder no one should have hit upon it before.

VI. Shall I venture to quote another observation from the same source? Yes; for what the writer says in regard to the notion of Grecian architecture requiring greater attention to study and rules than Gothic does, is well worthy of attention. "There cannot be a greater mistake. Gothic architecture *appears* less formal and less regular than its ancient rival, only because it embraces *more* elements of calculation,—because it has *more forms and rules of art*." True, most true! A person may go through the whole of Grecian architecture—may learn all the Five Orders, *secundum artem*, in less time than he can make himself acquainted with the varieties of Gothic doors or windows, or any other single feature belonging to that style. Carpenter's Gothic indeed,—or even the Jemmy-Wyatt Gothic is a different matter;—that is *regular* enough, all done *by rule* without any study, and therefore regularly bad, or at least insipid.

ON LONG AND SHORT STROKE STEAM ENGINES.

By John Seaward, C. E.

A popular notion has for a considerable time past prevailed, that a long stroke engine is much superior to a short stroke engine; and it will consequently be found that the practice of most, if not all engineers, is greatly regulated by this idea. On very careful consideration, however, it does not appear that this alleged superiority can be satisfactorily proved. That a long stroke engine, under certain circumstances, may be much more advantageously employed than a short one, is undoubtedly true, but considering the steam engine *per se*, that is without reference to adventitious or extraneous circumstances, it would be difficult to show that the former has any advantage whatever over the latter.

For let a careful comparison be made of a long stroke engine with a short stroke engine; let there be two beam engines of thirty horses power each, both equally well made, but the one having a stroke of eight feet, while the stroke of the other is only four feet, the cylinder of the latter being double the area of that of the former; it being understood that both engines shall make the *same* number of revolutions per minute; the steam passages and valves to be of the same area and capacity; and the two engines in all other respects to be well proportioned and made without any limitation as to space or weight.

Now as regards the mere mechanical effect of the moving power (*i. e.* of the steam) it is perfectly clear that it must be precisely the same in both engines, because the same volume of steam must produce the same mechanical effect whether it is let into a long narrow cylinder or into a short wide one; therefore, if there be found any difference in the efficient duty or economical working of these two engines, that difference must arise from circumstances quite unconnected with the mechanical effect of the steam power.

The only circumstances which really can make any essential difference in the efficient duty or economical working of these two engines are these:—First, the greater or smaller quantity of friction in the various parts of the machines. Second, the greater or lesser radiation of heat from the cylinders and passages; third, the greater or smaller loss of steam by the clearance of the piston at the top and bottom of the cylinder. Fourth, the *inertia* and the impulse of the parts of the machine in motion on the surrounding air.

First, then of the *friction*. It will be found in the working of a well made engine of the proportions of the short stroke engine under comparison, that more than four-fifths of the whole friction are due to the packings of the piston and air pump bucket, and of the piston rod and bucket rod,* and less than one-fifth to the main gudgeons, the end gudgeons, the crank pin and other moving joints about the engine. But the friction of the piston packing will vary as the circumference of the piston, multiplied into the distance which the piston travels. Now in the long stroke engine the piston supposing it to be 30 inches diameter, will move eight feet, and the friction of the packing be therefore as 24, while in the short stroke engine the piston will be about 42·4 inches diameter, will move only four feet, while the friction of the packing will be only as 17. In the same way it can be shown that the friction caused by the packing of the air pump bucket, of the piston rod, and of the bucket rod, is also respectively in the ratio of 24 to 17, in the two engines. With respect again to the friction due to the main and end gudgeons, &c., it is clear that it will be less in the long stroke engine, because in the latter engine, the force acting upon these parts will be one-half what it is in the short stroke engine. Assuming therefore 100 to be the whole quantity of friction in an ordinary engine then, 80 of these parts in the short stroke engine, will be due to the piston, air pump, bucket, &c., while in the long stroke engines the friction of these parts will be as 113 that is $= \frac{24}{17} \times 80$, but the friction on the main and end gudgeons in the former engines will be as 20, and in the latter only 10, making the total friction in the short stroke engine 100, and in the long stroke engines 123, or one-fourth more.

Second.—The *radiation of heat* will be in proportion to the extent of surface, but the surface of the long stroke cylinder, is much greater than that of the short cylinder, whence it follows that the loss by radiation in the former, must be greater than in the latter.

Third.—The *clearance of the piston* at the top and bottom of the cylinder, which will evidently be greater in the short stroke engine than in the long stroke engine. Because the area of piston in the former is double that of the latter, some persons would be disposed to say, that the loss by clearance in the former must be double what it is in the latter; but this is not quite certain, for it is not required to give so much clearance in a 4 feet stroke cylinder as it would be advisable to give in an 8 feet stroke cylinder, the reason of which is obviously that the spring and elasticity of the parts in the long stroke engine, must be much greater than in the short stroke engine, and that they must therefore require more clearance. However, it is probable that there would be more loss in the latter engine than in the former.

The loss of steam by filling the passages and nozzles, as also by the radiation of heat from those parts, must evidently be the same in both engines.

Fourth.—*The inertia and impulse of the moving parts on the surrounding air.* The loss in a steam engine occasioned by these two causes may not be very considerable; indeed as regards what is called the *inertia* of matter in the moving parts, it is doubtful whether any such source of loss really exists; however if it does exist, it is clear that the amount of loss must vary in proportion to the *momenta* of those parts of the machine which are in motion, but as the *momenta* must be as the mass of matter in motion multiplied by the velocity, and as these are evidently much greater in the long stroke than in the short stroke engines, (because the parts in the former, are if any thing, of greater weight than in the latter, and also move at a double velocity,) it follows that whatever loss may arise from the *inertia*, must be much greater (double?) in the long stroke engine than in the short stroke engine. With regard to the loss occasioned by the impulse of the moving parts on the air; it must be admitted that in very slow motions it cannot be very important; nevertheless with a material increase of velocity this source of loss becomes serious; it varies as the extent of surface of the moving parts multiplied into the *square* of the velocity. It is tolerably manifest however that the surface of the moving parts in the long stroke engine, will be, if any thing, greater than in the short stroke engine, and that the velocity of the former will be twice that of the latter; therefore the loss by impulse on the air in the long stroke engine, must be four times that in the short stroke engine.

Beside the foregoing causes, it is doubtful whether there are any others that can produce any material difference in the efficient duty or economical working of a steam engine; at least none that can in any way influence the question now under consideration. In estimating therefore, the advantages of the short and long stroke engines, we have in favour of the former a diminution of loss occasioned by friction, by radiation, by *inertia*, and by impulse on the air; while on the other hand, we have in favour of the long stroke engines, a diminution of loss in the clearance of the piston at the top and bottom of the cylinder. It may be difficult to strike an exact balance between these several sources of loss; but there can be no doubt that in a steam engine the loss by friction is much greater than the loss by all the other causes before mentioned put together; and it is past dispute that the balance of loss as regards these causes, is decidedly against the long stroke engine. (The advantages offered by the short stroke engine as regards diminution of space and weight, although of vast importance, are not here adverted to, because they form no part of the immediate inquiry.)

It may be objected that to select an engine with an 8 feet stroke and a cylinder of only 2½ feet diameter for comparison, is not a fair proceeding, because an engine of such proportions is unusual; and it may be also asked whether, if the principle is further extended by making the stroke only 2 feet, and again doubling the area of the piston, whether the advantage would still be in favour of the short stroke engine?

To this it may be answered that although an engine of 8 feet stroke and 2½ feet diameter of cylinder, may be unusual in this country, it is not so in America; in that part of the world, many engines are employed of very nearly the above proportions, for purposes of steam navigation; and in which engines it is not unusual for the piston to travel at the rate of 300 or 400 feet per minute. Again, as regards the carrying out of the principle by still farther reducing the length of stroke, say to two feet, and increasing the diameter of cylinder proportionately, say to 5 feet; there is no doubt whatever that such an engine would have precisely the same mechanical effect as either of the other two; but the balance of advantages would be against an engine of such proportions; because it would be verging to an extreme on one side as much as the 8 feet stroke engine may be thought extreme on the other side. It may, however, be safely affirmed that the principle applies most powerfully to the case where the diameter of cylinder is the same as the length of stroke; because in that case the proportions are most favourable for the diminution of friction and of radiation, and offer the minimum of disadvantage under the several heads of loss above enumerated.

As it is manifest, therefore, that in all particulars which more immediately affect the beneficial employment or working of a steam engine, the long stroke has no manifest superiority over the short stroke; it may appear strange that so decided a preference should have hitherto been given to the former by the generality of engineers.

---

* The friction of the slide is not included, as that will obviously be the same in both engines. See remarks on Friction at the end.

Perhaps this is chiefly to be attributed to the circumstance of the long stroke offering on most occasions greater convenience than a short stroke. Much may be due also to fashion. The earliest application of steam power was for the purpose of pumping water in the course of mining operations, and in this sort of work a good long stroke was found to be attended with considerable convenience and advantage. In blast engines, and many other of the earlier applications of steam power, the same result was manifest; the earlier habits and ideas of engineers were therefore naturally associated with long stroke engines. Moreover, the earlier manufacturers of steam engines had neither good machinery nor good workmen; they could neither depend upon the correctness of their proportions, nor upon the exactness of the workmanship; besides, timber and other inefficient materials were formerly employed to a considerable extent in the construction of engines; from all which causes imperfections and irregularities were numerous in the earlier engines, and they were consequently very inefficient. As all these sources of imperfection and inefficiency operated much more extensively against short stroke engines than against long, it is no wonder that the latter soon obtained a preference, and that the prejudice should still continue to exist, notwithstanding the same causes are no longer in operation. At the present day, with our good materials and workmanship, exact proportions and adjustments, a short stroke engine will be found to work as accurately and as perfectly as a long stroke engine.

There is one very important circumstance to be kept in view as regards long and short stroke engines; which is, that whenever an engine of the latter description has hitherto been made, it has always been considered necessary to keep the cylinder nearly of the same diameter, as in the long stroke engine, and to cause the engine to make a greater number of revolutions in proportion to the shortness of the stroke, so that the piston in every case might travel at a nearly uniform speed of about 200 feet per minute. Now, to a short stroke engine, made on this plan, there may undoubtedly be many objections. The more frequent alternation of the stroke—the greater loss of steam by the more frequent filling of the passages and nozzles, and the clearance at the top and bottom of the cylinder—the much greater angular motion of all the bearings and moving joints, thereby materially increasing friction and wear—are all circumstances tending to lessen the efficiency of a short stroke engine made upon this plan. It is clear however that an engine made upon the principle, herein before laid down, is not open to the same objections.

And, as regard the speed of the piston in engines, whatever may be the length of stroke, being regulated to the uniform standard of about 200 feet per minute, there can be no valid reasons given for such rule; no one can prove that double the above speed, or only one-half that speed, might not be employed with equal or greater advantage; it is certain that in many steam engines of the transatlantic world the pistons move at a speed of 300, 400, and even as much as 500 feet per minute, and no substantial reason can be alleged why such engines should not do good duty; indeed it may be safely affirmed, that whether the speed of an engine be 100 feet, 200 feet, or 300 feet per minute, it matters nothing; provided all the parts of the engines are well proportioned for the proposed speed, the efficient duty and economical use of the engine will be much the same: keeping this always in mind, that *the slow speed will be more favourable for the easy and pleasant working of the engine, and for durability.*

This question may however be asked—Since it is shown that the long stroke has no superiorify over a short stroke, but on the contrary that the balance of advantage is rather in favour of the latter, is it intended to recommend the invariable adoption of a short stroke engine to the total exclusion of a long stroke? By no means. All that is contended for is, that in every case a length of stroke should be adopted whether long or short that shall prove to be most convenient, and best adapted to the object for which the engines are to be employed; and that an engineer should not be fettered and cramped by any fallacious abstract notions, that what is termed a long stroke engine must necessarily be more efficient than an engine with a short stroke; and that he should not therefore be obliged to sacrifice many other far more important considerations, for the sake of obtaining in every case the longest possible stroke.

The application of steam power for the purpose of navigation has had such wonderful results, the character of the steam engine has become so greatly changed, and the proportions so altered, that a marine engine of the present day, and a land engine of former times can scarcely be recognised as belonging to the same class of machines. The length of stroke of marine engines is probably not more than half what used formerly to be given to engines of similar power for mining and manufacturing purposes, but still no one can say that this departure from old rules and maxims has been attended with any disadvantage; on the contrary, it can be shown to have been most beneficial and glorious in its results; and if a still further departure from old established notions can be proved advantageous for steam navigation, we can have no reason whatever to regret the change.

There is no question that the ordinary beam engine as employed in steam vessels has proved most efficient, and that in its application it has been productive of vast benefit. If however, by a modification of the existing steam engines, these benefits can be still further augmented, and that in an eminent degree, no consideration ought to stand in the way of the proposed improvements. The great and paramount objects to be aimed at in the construction of steam engines for navigation are the following, viz., the greatest saving of fuel, the greatest saving of space, the greatest saving of weight, and the greatest durability of the machinery. The more eminently the marine engine shall combine the above important qualities, the more nearly will it have arrived at perfection; and much as may be advanced in favour of the beam engines generally used for marine purposes, it cannot be considered presumptuous to declare that the system of engines employed in the "Cyclops" and "Gorgon" Frigates is far superior in all the qualities before enumerated.

It only remains to be stated, that the real question is, not whether the stroke of an engine shall be 8 feet or 4 feet; but relates to a difference of stroke, of probably from 7 feet to 6 feet: that is, whether the reducing of the stroke of a 200 horse engine *one foot*, with a proportionate increase of diameter in the cylinder, can be attended with such injury and inefficiency as shall wholly neutralise or outweigh all the important advantages of the Gorgon Engines.

In conclusion, it should be observed that as regards the ordinary beam engines, there are many circumstances of convenience which render it advisable to make the stroke as long as practicable, *i. e.*, the adopting a tall narrow cylinder instead of a short and wide cylinder; for in the arrangement of the ordinary beam engine for marine purposes, it is evident that a considerable space lengthways is required for conveniently placing the slide jackets and passages, the condenser, the hot-well, and the air pump; this necessarily causes a great elongation of the side levers or beams; there is therefore much local convenience in making the stroke long, and thereby having a tall narrow cylinder instead of a short wide cylinder, less strain is thrown upon the beams; the beams become more close and compact, and afford more space for a passage between and on the off-sides of the pair of engines: the cross-heads and fork-heads become shorter, and have much less strain thrown upon them; these are all very important considerations which clearly indicate the convenience and possible advantage of having as long a stroke as possible in the ordinary beam engine. But in the Gorgon Engine none of these considerations have any influence whatever; here there are neither beams nor cross heads; we can increase the diameter of the cylinder to almost any extent without any local inconvenience whatever.

We shall conclude these observations with the remark, that as it cannot be proved that there is any superiority in a long stroke engine, over a short stroke engine, and as it is also evident that there is no disadvantage whatever in employing a short connecting rod, it is therefore clear that the two objections are decidedly absurd and groundless.

OF THE FRICTION IN STEAM ENGINES.

In the preceding pages we have offered an investigation of the comparative merits of the Gorgon, and of the common beam engine; in the course of our remarks it became necessary to advert to the important subject of friction; it will not therefore be deemed misplaced to add a few general remarks upon the nature of the friction, which occurs in a steam engine of the usual construction.

To attempt anything like a correct estimate of the absolute quantity of friction in an engine, would we conceive be very fallacious, because there are so many circumstances which affect the quantity of friction, which are quite beyond the reach of calculation; as for example, the uncertain degree of tightness to which the several bearings or packing may be screwed down—the state of the rubbing surfaces, as to smoothness, polish or roughness—the perfect or imperfect state of the lubrication, &c., all of which are circumstances which have a vast influence on the quantity of friction in a steam engine. From observations which the writer has made he is induced to believe, that in a well made engine, in good working condition, the total amount of friction does not exceed five or six per cent. on the whole power of the engine; but that with no very great change of circumstances this quantity may be increased readily to as much as 10 or 12 per cent.

It happens however that in the preceding investigation, the consideration of the absolute quantity of friction in the engine, is not required; all that is wanted is an estimation of the relative proportions of friction which are due to the several parts of the engines; now this sort of estimation is not very difficult, at all events we can arrive at an approximation sufficiently near for practical purposes.

For, if we assume that all the moving or rubbing surfaces throughout the engine are equally smooth, that all the packings and bearings are uniformly secured down, that all parts are well lubricated; then the comparative quantity of friction in the several parts will be, as the area of one of the rubbing surfaces, multiplied into the distance which it moves up on the other rubbing surface.

We obtain thus the following rules:—

1. For the relative quantity of friction due to the piston, multiply the circumference of the piston by the depth of the packing, and by the distance which the piston moves up and down in the cylinder.

2. For the friction of the main shaft bearings, multiply the square of the circumference by the length of the bearing.

3. For the friction of those bearings which do not revolve entirely round, but oscillate backwards and forwards, as the beam, gudgeons, &c., multiply the area of the bearing into the angular distance moved backwards and forwards during one revolution of the engine, &c.

4. It should be observed, however, that when one of the two rubbing surfaces is hemp packing, the amount of friction will be at least double what it will be when both surfaces are metal.

5. Furthermore, there are certain bearings which receive the direct strain of the engine, while others do not. The following receive the direct strain, viz.; the crank pin, the fork head gudgeons, the main gudgeons, the upper and lower bearings of the side rods; now the quantity of friction upon these several bearings will be considerably more than that which is simply due to the tightening down of the bearings, as before assumed; it is difficult to say what may be the increase of the friction from this cause, but it will be safe to assume that the friction on these bearings will be three times greater than what is due to the other bearings.

Upon the foregoing principles therefore, is calculated the following table of the comparative friction of the different parts of an engine, having a 40-inch cylinder, a 3½-feet stroke, and furnished with the common D slide.

Table of Comparative Friction of the moving parts of a Steam Engine.

2 (rule 4)	125½ in. circum. 4 in. deep. 84 in. dist.	84·336		Piston, with hemp packing 4 in. deep, moving a distance of 84 in.
2	13 in. circum. 4½ in. deep. 84 in. dist.	9·828		Piston rod, hemp packing 4½ in. deep, moving 84 in.
2	82 in. circum. 3 in. deep 42 in. dist.	20·262		Air pump bucket, hemp packing 3 in. deep, and moving 42 in.
2	8 in. circum. 3½ in. deep 42 in. dist.	2·352		Bucket rod, hemp packed 3½ in. deep, moving 42 in.
2·2	12 in. circum. 3 in. deep 42 in. dist.	6·048		Two plunger poles, with hemp packing 3 in. deep, moving 42 in.
	15 in. wide 8 in. 2 faces deep 14 in. dist.	10·059	Flat face 1·680	The slide face metal and metal back hemp packed, 6 in. at top, 6 in. at bottom, moving 7 in. each way.
2	24 in. circum. 12 in. deep 14 in. dist.		Back, hemp 8·064	
2	4½ in. circum. 2½ in. deep 14 in. dist.		Slide rod 315	
2	25 in. circum. 9 in. length 25 in. dist.	11·250		The two main shaft bearings moving entirely round metal and metal.
	18 in. circum. 9 in. deep 18 in. dist.	2,268		The bearing at outer end of paddle shaft
3 (rule 5)	15½ in. circum. 6 in. long 15½ in. dist.	4·323		Crank pin, moving entirely round and receiving the direct strain of the engine.
3-2—	10 in. circum. 3½ in. long 2½ in. dist.	·525		The two fork head joints moving at an angle of 45° each way, but receiving the direct stain of the engine.
3-2—	10 in. circum. 3½ in. long 2½ in. dist.	·525		Two lower bearings of side rods same as fork head joints.
3-2—	18 in. circum. 7 in. long 9 in. dist.	6·804		The two main gudgeons receiving the strain of the engines and moving 90° each way.
	45 in. circum. 13½ in. deep 45 in. dist.	3·543		Eccentric ring moving quite round.
		1·000		Sundry small joints.
		163·123		

Therefore, if it be assumed that the total quantity of friction in a steam engine is as 163·123, then will the relative quantity of friction in the several parts be nearly as is represented by the numbers in the preceding table.

ON THE THEORY OF TOLLS UPON CANALS AND RAILWAYS.

Sir—As I am aware that Mr. Ellett's remarks on Canal and Railway Tolls, extracted in your Journal for September, have attracted some attention, and have been received as sound and judicious principles by some persons, who are in a position which enables them to carry out these principles into practical operation, I beg to offer a few observations, with the view of pointing out what I conceive to be erroneous in Mr. Ellett's statement.

Mr. Ellett's object is, so to regulate the charge of toll upon a canal or railway, as that every part of the country through which the line passes, near or remote, may derive from the improved mode of conveyance the same advantage, an equal share of trade. And he contends that this cannot be effected by the system of tolls that generally prevails, namely, a fixed mileage, or a certain rate per ton per mile; and he therefore recommends the adoption of the directly opposite method, viz., that the lowest charge should be levied on the trade that is brought from the greatest distance, and increasing gradually as we approach nearer to the mart or place of consumption, that the heaviest toll should be charged on that which comes the shortest distance. And Mr. Ellett then proceeds to show that this plan would produce the largest trade, (that is, would command the largest extent of country,) and the greatest amount of revenue.

Now all Mr. Ellett's argument depends upon one little assumption, which he quietly introduces, without remark or explanation, quite unconscious that it contains the grossest fallacy. The market price of any commodity at the place of consumption may be said to be fixed, (for our present purpose,) and, in order to obtain a sale for this commodity brought by the canal or railway, the cost of production and the expense of conveyance must not exceed the fixed market price. Mr. Ellett takes for granted that *the cost of production* is fixed also, and on this rests the whole theory of tolls. "Let us also assume that the cost of producing this article (lumber) is 6 dollars per ton," and the market price being fixed (10 dollars,) he consequently assumes that the extreme cost of carriage which the article can bear, so as to be sold in the market, is fixed too, that it must not exceed 4 dollars, in the instance given. But he assumes also, and it follows in like manner from the preceding assumption, that *the cost of production is fixed*, that the article can always bear this fixed charge of 4 dollars, that whether the commodity be brought from near or far, whether it is carried 100 or 400 miles, it can always bear the full charge of 4 dollars for carriage, and cannot, in any case, afford more. And on this assumption Mr.

Ellett builds his theory,—that as the cost of carriage consists of two parts, the actual expense of conveyance, including the maintenance of the canal or railway, called *the freight*, and the profit of the canal proprietors, called *toll;* and as the freight must necessarily be directly proportional to the distance, the toll (their sum being fixed) should be inversely proportioned thereto.

Even were this principle correct in theory, it would in practice be exceedingly unjust, and therefore injurious. For nothing can be more unreasonable than that the trade which passes along the canal but 50 miles, should pay three times as much toll as that which comes 150 miles, thus paying actually *nine times* its due proportion. Let it be observed also that Mr. Ellett's system is one that can be fully carried out only on such a canal or railway, as has to sustain no competition with common roads. On the latter the charges of conveyance will always be directly proportioned to the distance, and being lowest for the nearest parts, will of course successfully compete with the canal or railway, whose toll is *here* the highest. The maximum charge for conveyance being 4 dollars, and supposing with Mr. Ellett that land carriage is five-fold more expensive than by the "improvement," it will, according to the scale given by him, be cheaper than the canal for the first 40 miles, (one-tenth of its whole length,) and from so much of the country, therefore the canal will derive no trade. With us the proportion of the cost of land and canal carriage is much nearer, perhaps greater than two to one; and the portion of the country commanded by the superior cheapness of land carriage, under Mr. Ellett's system of tolls, will be proportionately larger. Wherever there is the competition of another conveyance, on which the charges are made according to the distance, the inverse system of toll will be impracticable.

Leaving, therefore, for the present, the practical objections to Mr. Ellett's proposed system, I turn again to that which forms the basis of his whole theory, and which I conceive to be a most fallacious assumption. I am indeed surprised that any one writing upon such a subject, who ought to have some acquaintance with the principles of Political Economy, should hazard, or should carelessly make, an assumption so opposed to the mere elements of that science, as well as to ordinary experience. So far from *the cost of production* of any article being a fixed sum, throughout an extensive district of country, it is dependent upon, and varies exceedingly with, a great many circumstances. Every one knows that there is a difference of prices in many markets throughout the kingdom, and the price *at the place of production* is, *generally*, the actual cost of production, added to the usual profits. For reasons which will be noticed hereafter, the cost of production, and consequently, prices differ less in an improved country like England, than in one possessed of fewer artificial advantages, such as America or Ireland. But the fact is notorious to every one, that differences do exist in the expenses of production, at different places, of commodities of the same quality, and of equal value at the place of consumption.

The cost of production is made up chiefly of rent, the wages of labour, and the profits of the producer, (and, in manufactures, of the price of the raw material.) *Rent* is well known to vary exceedingly in different parts of the country, even for lands of the same kind, and equal fertility. *Wages* differ too, not only between the manufacturing and agricultural districts, but also between different districts engaged in the same occupations. Profits differ likewise, but being nearly in a fixed proportion to the total cost, they need not be considered separately. As, then, the component parts of the cost of production thus vary throughout the country, their sum, the total cost, cannot be said to be fixed. Yet Mr. Ellett seems to have forgotten these facts, palpable as they are to every man's observation.

There are, however, certain articles whose value is very small, and the cost of production of which consists merely of the wages of the labour employed upon it; and this labour being of the coarsest kind, its wages vary but little. Of such commodities the expense of production cannot differ much, and may be said to be fixed. Such are stone, lime, and, in a wooded country like America, timber, and perhaps coal, ores, &c. It is to such products Mr. Ellett chiefly applies his theory, but he does not confine it to them. He intimates that some other principles come into operation with reference to the more valueable articles of trade. But as I have not seen his observation on that part of the subject, and as it appears to me that his principle, if correct, must be equally applicable to every branch of trade, and as I know that it has been so interpreted and applied by some of his readers, I have discussed the subject generally, endeavouring to refute the theory in its application to either division of canal trade. In certain cases, then, it would appear that Mr. Ellett's assumption is correct, that the cost of production is fixed (or nearly so). But it so happens, that in these instances, our author's system of tolls would be altogether impracticable. The commodities are of such little value as to be scarce worth removing, unless at a very small cost; they cannot, in general, be brought from a distance, the necessary charge for freight, even if there be no toll, acting as a prohibition; and to have any trade, even from the nearest places, you must levy only the lowest rate of toll. Thus on the Irish Grand Canal the toll on stone is 6*d*. per ton, and on manure 4*d*. per ton for any distance,—because at higher rates they would scarcely be carried at all. And here, it is evident, there is no room for graduation according to Mr. Ellett's plan.

But resuming the consideration of the cost of production, where it is not fixed, let us examine into the causes of the differences that exist; why rent is high in one district, and low in another, and why wages vary so much as they are found to do in different parts of the country. Of course they all depend upon the economical principle of the relation of supply and demand. But in the same country, all parts of which are subject to the same laws and conditions of trade, and all contribute to the supply of the same great market, this relation between the supply and demand, that is the different values of rent and wages in the various parts of this district, depends mostly upon their respective distances from the place of consumption, and the facilities of conveyance thither. Near a large town, rent and wages, and consequently the cost of production, are high, because there the great demand can be most easily supplied, and with very little expense for carriage. Farther off, as the cost of conveying the products to the markets increase with the distance, both rent and wages are lower. And if a canal or railroad be made into the country, as it cheapens the cost of conveyance, and thereby facilitates its supplying the market, it raises rent and wages, or the cost of local production. Thus the true state of the case is very different from Mr. Ellett's theory. The cost of production is not fixed; it is found to depend on the charges for conveyance, varying inversely with them, (not in the same ratio,) that is, with the distance. Of course I speak here of the natural charge for conveyance, which consists of *freight* only, and is always proportionate to the distance. Such is the cost of carriage upon common roads, and as these are generally the first modes of conveyance, and the most universal, it is by the principles and circumstances that relate to them the cost of production is generally governed. In England the facilities for transport are so great, and so equally diffused throughout every part of the country, that the difference in the cost of production in different places is small, as I before mentioned. But in countries where the improved methods of conveyance are few, the difference of price, or the cost of production, at places at unequal distances from the market, or not having the same facilities, is often very striking. In Ireland, the price of potatoes, for instance, is frequently found to differ to an astonishing degree, in various parts more or less remote from the large towns; and the only cause appears to be the expense of carriage, which being in proportion to the distance, increases or diminishes the cost of production and the facility of removal.

If, then, the cost of production is found to vary, and inversely with the distance, the difference between it and the market price is not fixed, but varies directly with the distance; and the total sum which the commodity will bear as the cost of conveyance to the market is a varying quantity, increasing with the distance. The freight, one of its parts, is proportioned to the distance, and the other portion, the toll, should also, in general, be regulated by the same proportion. There are, of course, many circumstances which modify this law, at least in practice; but looking at the abstract question, I think that the theory of tolls, which the principles of economy and the laws that govern the relations of value and price indicate, is the simple, natural, and just system of charging according to the distance, in proportion to the benefit conferred, or to "the value given."

This is not only the true theory, but it is also the only system that is practicable, wherever there is the competition of common roads; it is easy to show that, in all cases, it would be the most profitable system also,—the most productive of revenue to the proprietors of the canal or railway; and at the same time the most impartial, and the most equally advantageous to every part of the country. Each district has its own advantages, in which it is superior to the others, and, under a natural system, its facilities for production and transport are proportioned duly to its means; while the retrograde principle must have the effect of encouraging the remoter districts, and depressing the nearer,—by destroying the natural and equable balance, which prevails in the social commonwealth.

I cannot trespass on your space, Sir, by entering further on the proofs that the natural system is also the most productive; neither could I do so without introducing diagrams, which would be found to differ very much indeed from those of Mr. Ellett. I shall only add, that I hold the true and most effectual mode of gaining for a canal or railroad the largest amount of trade and revenue to be MODERATE TOLLS, charged fairly according to the distance. I am convinced that the charges upon most canals and railways are much too high; that considerably lower rates would greatly increase their prosperity, and add vastly to the resources and commercial facilities of the country. Wherever the experiment of reduction has been tried, I believe it has proved successful, in augmenting the trade and its profits; and I have no doubt that soon the proprietors of many public works will be compelled, for their own sakes, to resort to such measures; and it is, therefore, of much importance that the principles of "the theory of tolls" should be clearly understood; and, conceiving that those advocated by Mr. Ellett are fallacious, unjust, and injurious, I have endeavoured to refute them,—and regret that the task has been so feebly and hastily performed.

C. E. B.

ON COMPETITION DESIGNS.

WE receive many letters on the subject of Competition, which are almost unanimous in complaining of the UTTER WANT OF GOOD FAITH on the part of those who invite architects to send in designs. And though we are sorry there should be room for such complaint in any instance whatever, we are glad to find that the evil itself prevails to so shameful an extent, because it is now likely that the profession will be stirred up to adopt some decisive measures to correct it. They certainly ought to do so; and we should advise a public meeting to be convened by them for that purpose. In the meanwhile our own pages shall be open to the exposure of the impositions now practised under the mask of Competition; and no doubt, many a strange tale might be unfolded that would open the eyes of the public to the mysterious doings of those Secret Tribunals which exercise an arbitrary and irresponsible power, and generally no less injuriously to the interests of architecture and good taste, than unjustly towards individuals in the profession.

From among the letters addressed to us on the subject, we give the three following as being well worthy of the attention of our readers, though we dare not promise the writers that their remonstrances will produce any effect.

SIR—The exposure made by your correspondent K. P. S. relative to the Bury St. Edmund's affair, ought to produce some good effect, yet that any is likely to result from it is more than can reasonably be anticipated; for not only are committees—even though composed of "all honourable men," perfectly callous to any thing like shame, but there is a sad want of energy in architects themselves, or they would even now have taken some decided steps to check the scandalous abuses—I may say, the barefaced impositions and deceptions attending competitions.

If there is positively no remedy for the evils complained,—why then in the name of common sense let them be endured, without any pitiful whining on the part of those who choose to lend themselves to a system of humbug.—Well, I have said *humbug*, and although that word is certainly not the most delicate, there is hardly another in the language that would be so appropriate, unless it were one more offensive still.—But remedy I am persuaded there is—at least to a very great extent, provided we choose to adopt such measures as will secure it. No doubt, there are many difficulties to be first overcome; but that, I conceive is a reason the more, why they should be boldly encountered, and the task of reform be set about with fearless resolution. Such reform ought to have been carried through by the Institute; because that Body might have taken up the matter actively without incurring the invidiousness and risk to which individuals might expose themselves by so doing. There was, indeed, an attempt of the kind, and a most feeble one it was,—amounting to nothing more than a little *palavering*. It would therefore have been greatly more to the credit of the Institute, had the subject never been brought forward at all; because now it looks as if the present vile system of competition was formally acquiesced in by those who ought to leave no stone unturned until they correct it. But there have been two other opportunities which, had they been properly turned to account, might have gone far towards bringing about the so-much-desired reform. As you will perhaps anticipate, I allude to the Nelson Monument and Royal Exchange Competitions, in both of which those who engaged in them, suffered themselves to be more injuriously and contemptuously treated, without venturing to protest against it. With regard to the first one, nothing could be a more insulting piece of mockery than the pretended Second Competition—without any warning on the part of the Committee, that they were decidedly in favour of some kind of Column;—although the result too plainly shows that they were predetermined to adopt Railton's design;—for had they not been so predetermined, they would at least have decently expressed their regret that they should have been driven into so particularly awkward a situation, being under the necessity of confirming their first choice, though aware that it would be in opposition to public opinion. No explanation, however, was offered—and what is much more, none was demanded by the Competitors.—Pity would be thrown away upon such pusillanimous creatures; for they have shown that they deserved to be kicked.

Had a bold and resolute stand been made then,—and the public would almost to a man have supported them;—had they called the Nelson Committee to account, and let the latter know that they were not wholly irresponsible; there can be no doubt but that it would have served as a most wholesome warning to the Gresham Committee, and the Royal Exchange competition would have been conducted very differently from what it has been. But in that, too, the Competitors have allowed themselves to be kicked like spaniels; and the authors of the Eight Designs which obtained the approbation of the professional umpires, suffered themselves to be set aside, and not permitted to try their strength again!

Tame, spiritless, pluckless! they have been served rightly, but THE CAUSE!—that has been most cowardly betrayed. Had those competitors been firm, the Committee would have chaunted *Peccavimus* in full chorus. Had not those Competitors been milk-livered the Committee would have blushed like boiled lobsters. But now, *Actum est! Perii!* And with such a memorable example—such a fatal precedent before them, future Committees may laugh at both competitors and the public.—There is but one chance left: and that is to urge Reform in Competition, incessantly; to discuss it in every possible shape, and without intermission;—and, not least of all, to insist in future upon Pre-exhibition of Designs,—not for merely a day or two, but for sufficient length of time, according to the number of drawings.

I remain, &c.

P. S.

SIR—Apropos to the subject of Competition there is an anecdote now circulating of so extraordinary a nature that it ought to be either publicly confirmed, or publicly contradicted. Reporting it, just as I heard it, the case is this: from among the designs sent in for the Protestant Memorial at Oxford, that by Mr. Blore was *unanimously* chosen, consequently whether such selection was actually the very best or not, it is evident that it was judged to be so by those who made it. But they afterwards discovered to their astonishment and mortification that they had clapped the saddle on the wrong horse, for misled by the name, they had decided in favour of that design, taking for granted that it was by *the* Mr. Blore who has been employed at Buckingham Palace, &c. As soon therefore as they detected their error, and ascertained that *their* Mr. Blore was a different individual, and one comparatively unknown in the profession, they came to the worthy resolution of setting aside the design, which had previously been approved of by them merely through ***mistake!*** Is not this a most delicious anecdote? Does it not speak volumes as to the sort of discrimination, and the kind of integrity and good faith, displayed by *gentlemen* on such occasions? And mark you, I pray, this extraordinary tergiversation was not manifested in a paltry hole-and-corner competition in some obscure town and village, but in—Oxford!—the seat of learning, and of orthodoxy.

Unless the matter is altogether misrepresented—in which case it becomes the duty of those who are concerned in it, to clear themselves from so highly injurious a charge,—Mr. Blore has sufficient grounds for bringing his action for damages against his quondam judges; and would no doubt obtain them to a very heavy amount, because he has not only suffered pecuniarily, but may be said to have been stigmatised in his professional character, having been formally set aside as incompetent, consequently placed in a very different situation from the other unsuccessful competitors.

Delenda est Carthago: the Humbug and Deception now attending Competition must be blown up,—the present system must be entirely reformed; and as the Institute will not exert itself at all in the cause, so much the more manfully must individuals do so. The pen and the press must bring the subject continually before the profession and the public, until both shall be completely roused: and then, perhaps, when the needed reform shall have been commenced by others, the Institute will valiantly profer their services, and come forward to share in the merit of the victory.

I remain, &c.

J. P. M.

SIR—In the No. for this month of your excellent Journal, there is an article on Architectural Competition signed "K. P. S," in which some "facts" are detailed relative to that subject, especially as relates to a church to be built or now building at Berry.

If "K. P. S." was aware of how these matters are managed with us in Ireland, it might excite his honest indignation still more, as the system generally adopted here is to place all the competition designs submitted into the hands of a favoured architect, from which to choose and model such plans as the committee may direct, who *kindly* indulge the favourite with the necessary time.

It may be supposed that the writer is a disappointed candidate, and that this is merely the ebullition of his chagrin and mortification from defeat. Not so; for having had the benefit of seeing the fate of others on these occasions, he has invariably steered clear of this species of competition.

An instance of the flagrant injustice done in this way took place a short time since, wherein architects were invited by public advertisement to send in plans for an edifice to be erected near Dublin, to be appropriated as a place of worship. After the plans, &c., had been sent in, considerable shuffling took place on the part of the committee. At length, after frequent postponements and delays, it was announced that none of the designs, in their judgment, were suitable to the required building, although they numbered upwards of a dozen designs, some of which were shown to me previously, and possessed (in my opinion) very great merit, and were in strict accordance with the rules laid down in the advertisement. In a short time afterwards the building was begun, after the design and inspection of an architect who had not competed, and as the building is now nearly completed, I can, without fear of contradiction, assert that it is a "fac simile" (as far as I have been able to examine it) of one of the designs I had been shown, and which was sent in to the committee.

The profession of an architect is completely degraded in Ireland; for instance, in the erection of any county public building (the architect, if indeed any be engaged at all) is merely a subordinate to the county surveyor, who, with very few exceptions, know nothing of our profession, and until the clause which relates to this subject in the present Grand Jury Act is remedied, things must remain in this state. At present every public work is placed in their hands, and, generally speaking, when anything architectural (or at least what should be architectural) is to be done, they attempt it themselves, and a pretty finish they make of it, instances of which are but too numerous.

Again, a paragraph is now going the round of our papers, eulogizing a new Saving's Bank erected in Limerick, "*by Sir Thomas Deane, the* EMINENT ARCHITECT, *the progress of the work was superintended by William H. Owen, Esq.*, CIVIL ENGINEER, *whose professional taste and skill are so highly appreciated.*"

Not wishing to occupy too much space in your valuable journal, I have merely glanced at some of the strange doings perpetrated here, which, if properly "*shown up*," would undoubtedly throw the grievances complained of by K. P. S. into the shade.

I am, Sir,
Your very obedient servant,
J. A., Architect.

Dublin, Oct. 12, 1840.

LAND SURVEYING.

SIR—I should not trespass on your very valuable time, and on the pages of your most deservedly popular Journal, did I not know that you make it your study to give publicity to every thing, however trifling, which may be of use to any member of the profession, whose interests you so very ably advocate on all occasions. Should this obtain your approval, your insertion of it will much oblige the writer.

It has, I dare say, occurred to every one engaged in an extensive survey, that there is a great danger of mistakes taking place in the change of pins in a long chain line; as the number of changes or removes must be kept in memory, and one is very likely to become confused if there are a great many of them. To obviate this inconvenience, I would beg to propose a very simple plan, viz., that the leader should be provided with a small bag, containing a number of common marbles, such as school-boys employ in their games; and that on giving up his pins to the follower, or hind chainman, at every remove, he should give him one of these marbles, to be kept by the follower in another bag provided for the purpose, until they arrive at the end of the line; when each marble will stand for 10, and the pins in the follower's hand, as usual, for single chains.

By this method nothing is left to the memory, and of course a greater degree of certainty is obtained.

I have the honour to remain, Sir,
Your most obedient servant,
E. WILLIAM MANSELL.

Dublin, Oct. 3, 1840.

LAND SURVEYING.

SIR—I observe in your last Number an extract from Mr. Bruff's Treatise on Engineering Field Work, wherein he says, in describing the new instrument for measuring the contents of maps, that "the principle of the plan has been long known to some few suveyors, but that they prudently kept it to themselves, &c." Now, Sir, I should very much like to know the names of any surveyors to whom the instrument was known before its introduction into the Tithe Office, and perhaps Mr. Bruff will be good enough to afford this information through the medium of your Journal, as it is certainly important to know to whom surveyors are indebted for the invention of this instrument, which most justly deserves all the praise that can be bestowed upon it.

I beg it to be understood, that in seeking this information from Mr. Bruff, I am actuated by no hostile or cavilling spirit, on the contrary, I think generally the contents of his work are most valuable, and strictly to be depended on; in this instance, however, I think he is misinformed, and believing that Mr. Bruff would not wish to deprive the inventor of his due share of credit, I trust he will have no hesitation in stating publicly, who are the parties to whom he alludes, as having long known the principle of the plan.

I am, Sir, your obedient servant,
AN OLD SURVEYOR.

London, Oct. 15, 1840.

THE NELSON AFFAIR.

MR. EDITOR—I send you some stanzas which you may, if you like, suppose were intended to have been put into the foundation stone of Railton's Column, but somehow or other escaped that honour; allow them therefore to be preserved in one of your columns.

ANTI-STYLITES.

NELSON *loquitur*:—

You see that I stick to my *post*,
Stuck up here on the top of a peg.
And having before but one arm,
I am now left to stand on one leg.

Though not on a leg made of wood,
Oh no!—'tis a leg built of stone;
And so wondrous tall too it is,
That I stand "all aloft and alone,"

Just after that whimsical fashion
Old Simeon adopted of yore;
But then he was a saint most sublime,
And his practice a bit of a bore.

Yes, my case is confoundedly hard,
Tho' some other folks' heads are quite soft,
So I wish they had left me *alone*,
Before they had left me *aloft*.

For Wightwick I see there is sneering,
While others are laughing outright,
And folks seem myself to be queering,
While they gape at my pitiful plight.

O! were but the stick I am stuck on,
A good walking-stick—by my fay,
I would not stand here to be quizzed at,
But with stick and all *walk away*.

PNEUMATIC OR ATMOSPHERIC RAILWAY.

SIR—The fairness that should guide a public Journalist, and a scientific one especially, will doubtless induce you to afford me a place to reply to an invidious article contained in your Journal for July, which does me great injustice—has an injurious tendency, and at the same time confers approbation on Messrs. Clegg and Samuda, who are endeavouring to avail themselves of the result of information communicated to them, whilst they were confidentially employed by me in 1836-7-8, in the construction of works and machinery designed for carrying into practical operation the pneumatic or atmospheric railway, which was intended to be applied on the Birmingham, Bristol, and Thames Junction Railway at Wormwood Scrubs, as the first prospectus of that railway (1835) will show, and on which line my invention is now pirated by Clegg and Samuda.

The article in your Journal appears intended as a disparagement of my invention. I have before publicly accused those persons of the conduct complained of in the Sun newspaper of the 17th and 19th June last. I am preparing to stop their proceedings through the medium of a court of justice, but that is no ground for my sustaining in the mean time injurious remarks, and the public mind abused through the columns of public journals.

I am prepared to prove that the system carried into effect, even in all its minute details, is wholly my invention; as well as the more improved applications of the same principle, as specified in my patents of 1834 and 1836, all of which are legally held by me under the authority of the Patent Laws, which forbid those persons or others from using any portion of that which is described in the article inserted in your Journal.

In regard to the remarks that "the idea of employing the power of the atmosphere against a vacuum created in an extended pipe laid between rails, and communicating the moving power thus obtained to propel carriages travelling on a road, we believe originated with Mr. Medhurst, in 1827, and that in 1812 he published some ideas on this method." And that "about 1835 some experiments were made with a model in Wigmore-street, by Mr. Pinkus, very similar to those described by Mr. Medhurst; these experiments, however, failed from the same cause probably, which prevented Mr. Medhurst from carrying his into effect, viz., the impossibility of making an air tight communication from the inside of the pipe to the carriage, tight enough to allow a useful degree of rarefaction to be produced."

Now, Sir, I have to complain that not even so much as one particular of all the allegations in the above quotations is true, and declare that I can disprove them all by documentary evidence of record, and printed publications of old dates. Myself an humble labourer in the field of science, I trust I shall never be guilty of that meanness of mind that would detract from another the merit justly due to him for any mental production, and I will contend for equal justice to myself.

First, then, the merit, and it is a high one of "employing the power of the atmosphere against a vacuum," and transmitting that power, as well as the suggestion of obtaining a similar power by plenum (the latter though impracticable) is due to the celebrated Papin, who suggested them 120 years ago, and not Mr. Medhurst.

Second. The suggestions and the experiment "employing the power of the atmosphere against a vacuum, and by impelling a piston through a tunnel," is due to Mr. Valance, who did it at Brighton in 1824, and not to Mr. Medhurst, who in 1810 only proposed the *impractical part of Papin's plan of forcing air under the compression of many atmospheres*, as several others before him had done; and added at a subsequent date the idea of moving a piston through *an underground tunnel*, by forcing in *air behind it*, from distances of 20 miles apart, and so impel goods and passengers therein. In 1824 Mr. Valance took out a patent for his method of an *underground tunnel*, and the *more correct and practical principle* of rarefaction and atmospheric pressure.—Mr. Medhurst, who held no patent, made claim to Mr. Valance's invention of transmitting a piston through an underground tunnel.—Mr. Valance in a pamphlet of that date, answered Mr. Medhurst, and pointed out in what his invention differed from the other's claims; thus both Papin and Valance went before Mr. Medhurst.

In 1825, not 1835 as is alleged, I proposed to apply Papin's principle by a new method, combination of apparatus and machinery, whereby I was enabled to transfer the power generated under *partial vacuum to the exterior of extended* mains or pipes laid on the margin of a canal or railway, and transmitting the power so generated along such main. I combined the main with a canal, and proposed to use Brown's Gas Vacuum Engine as the prime mover, my plans and specifications were recorded, my models constructed and exhibited: these contained such a mechanical arrangement for effecting a propelling power under rarefaction, *as alone admits of its application at all;* subsequently they became the subject of the first patent (1834) ever taken out for that object. As I was for the first time informed in 1836, Mr. Medhurst in 1828 reprinted his pamphlet of 1810, for the Underground Tunnel and the application of a *Plenum*, and with it, now for the first time proposed to transfer the power to the outside of the underground tunnel, and to have stationary engines 20 miles apart for forcing in air, he shewed a lithographic drawing of the method, and having 4 years before claimed the plan of Valance, and 3 years before of my method of transferring the power of partial vacuum to the exterior of a main, he proposed a long box and a pipe suspended over a channel of water in order to make a water-joint; these suggestions made at that late date, were nevertheless so crude and undigested, as to be utterly impracticable as they show. His calculation based upon them he can in no way obtain. He never made an experiment, as I am well informed, and his pamphlet was in the hands only of private friends; I saw one, for the first time, in 1836. Having been engaged until 1830, I in that year again prepared fresh plans and specifications, such as are now enrolled, and exhibited them to friends. In 1833 I commenced my patent, sealed in 1834, and in that year constructed a large working model that was publicly exhibited, *and upon its success in* 1836 an association for working my system was formed, which is now extant; contracts were made for works to demonstrate the principle with my subsequent improvements, for which patents also were taken out in various countries. The works were designed to be applied on the Birmingham Bristol and Thames Junction Railway, at Wormwood Scrubs; those works were nearly completed, the line half a mile in length formed on the margin of the Kensington Canal, which was united with that line of railway. Samuda and Hague were the contractors for the engines, the former as well in the construction of the pneumatic mains and valve, and Samuel Clegg was confidentially employed and consulted, and witnessed the progress of the experiments during such employment, learned from me all the minute details that they have now carried into effect, but which are nevertheless held by me under patents. Clegg and Samuda saw my experiments in 1835-6 made upon rough models, but which were attended with perfect success, only some of the details were purposely omitted until further patents were sealed.

Not only, therefore, is the invention in all its details my own, and legally held by my patents, which embrace such mechanical combinations, as without which that well known principle cannot possibly be carried into effect, but I shall, when my interest best requires it, stop their further progress.

I am, Sir, your obedient servant,

H. Pinkus.

11, *Panton Square, Aug.* 20, 1840.

MUSEUM OF ECONOMIC GEOLOGY,

CRAIG'S COURT, CHARING CROSS, LONDON.

(Extract from the President's Address of the Geological Society of London.)

Among the most important of the remarkable events of the past year, we recognise with gratitude and confident anticipation of great advantage, both to science and the arts, the establishment by her Majesty's government of an institution hitherto unknown in England, namely, a Museum of Economic Geology. This is to be freely accessible to the public at stated periods, in the department of her Majesty's Woods and Forests, and Public Works, for the express object of exhibiting the practical application of geology to the useful purposes of life. In this Museum, a large store of valuable materials has already been collected and arranged, chiefly by the exertions, and under the direction of Mr. De la Beche. In it will be exhibited examples of metallic ores, ornamental marbles, building stones and limestones, granites, porphyries, slates, clays, marls, brick earths, and minerals of every kind produced in this country, that are of pecuniary value, and applicable to the arts of life. Information upon such subjects, thus readily and gratuitously accessible, will be of the utmost practical importance to the miner and the mechanic, the builder and the architect, the engineer, the whole mining interest, and the landed proprietors. The establishment will contain also examples of the results of metallurgic processes obtained from the furnace and the laboratory, with a collection of models of the most improved machinery, chiefly employed in mining. A well-stored laboratory is attached to this department, conducted by the distinguished analytical chemist, Mr. Richard Phillips, whose duty it already is, at a fixed and moderate charge, to conduct the analysis of metallic ores, and other minerals and soils submitted to him by the owners of mines and proprietors of land, who may wish for authentic information upon such matters.

The pupils in this laboratory are already actively employed in learning the arts of mineral analysis, and the various metallurgic processes.

A second department in the Economic Museum, will be assigned to the promotion of improvements in agriculture, and will contain sections of strata with specimens of soils, sub-soils, and of the rocks from the decomposition of which they have been produced.

To this last-mentioned collection, proprietors of land are solicited to contribute from their estates labelled examples of soils, with their respective sub-soils; and all persons who wish for an analysis of any sterile soil, for the purpose of giving it fertility, by the artificial addition of ingredients with which nature had not supplied it, may here obtain at a moderate cost, an exact knowledge of its composition, which may point out the corrective additions which it requires. This portion of the Museum will more especially exhibit the relations of geology to agriculture, in so far as a knowledge of the materials composing the sub-strata may afford extensive means of permanent improvement to the surface.—*Phil. Mag., October*, 1840.

St. James's Park.—An ornamental building in the Swiss style, consisting of council-room, bridge, and keeper's cottage, is now building in St. James's park for the Ornithological Society of London. The site is nearly opposite the Horse Guards, and the design, approved by the Board of Works, has been prepared by Mr. Watson, under whose direction it will be completed.

AN ACT FOR REGULATING RAILWAYS.

PASSED AUGUST 10, 1840.

No railway to be opened without notice to the Board of Trade.—Whereas it is expedient for the safety of the public to provide for the due supervision of railways: be it therefore enacted by the Queen's most excellent Majesty, by and with the advice and consent of the Lords spiritual and temporal, and Commons, in this present Parliament assembled, and by the authority of the same, that, after two months from the passing of this Act, no railway, or portion of any railway, shall be opened for the public conveyance of passengers or goods until one calendar month after notice in writing of the intention of opening the same shall have been given, by the Company to whom such railway shall belong, to the Lords of the Committee of Her Majesty's Privy Council appointed for trade and foreign plantations.

Penalty for opening railways without notice.—And be it enacted, that if any railway, or portion of any railway, shall be opened without due notice, as aforesaid, the Company to whom such railway shall belong shall forfeit to her Majesty the sum of 20*l.* for every day during which the same shall continue open, until the expiration of one calendar month after the Company shall have given the like notice as is herein-before required before the opening of the railway; and any such penalty may be recovered in any of her Majesty's courts of record.

Returns to be made by railway companies.—And be it enacted, that the lords of the said committee may order and direct every railway company to make up and deliver to them returns, according to a form to be provided by the lords of the said committee, of the aggregate traffic in passengers, according to the several classes, and of the aggregate traffic in cattle and goods respectively, on the said railway, as well as of all accidents which shall have occurred thereon, attended with personal injury, and also a table of all tolls, rates, and charges from time to time levied on each class passengers, and on cattle and goods conveyed on the said railway; and if the returns herein specified shall not be delivered within thirty days after the same shall have been required, every such company shall forfeit to her Majesty the sum of 20*l.* for every day during which the said company shall wilfully neglect to deliver the same; and every such penalty may be recovered in any of her Majesty's courts of record; provided always, that such returns shall be required, in like manner and at the same time, from all the said companies, unless the lords of the said committee shall specially exempt any of the said companies, and shall enter the grounds of such exemption in the minutes of their proceedings.

Penalty for making false returns.—And be it enacted, that every officer of any company who shall wilfully make any false return to the lords of the said committee shall be deemed guilty of a misdemeanor.

Board of trade may appoint persons to inspect railways.—And be it enacted, that it shall be lawful for the lords of the said committee, if and when they shall think fit, to authorize any *proper* person or persons to inspect any railway; and it shall be lawful for every person so authorized, at all reasonable times, upon producing his authority, if required, to enter upon and examine the said railway, and the stations, works, and buildings, and the engines and carriages belonging thereto: *provided always, that no person shall be eligible to the appointment as inspector as aforesaid who shall within one year of his appointment have been a director or have held any office of trust ar profit under any railway company.*

Penalty on persons obstructing inspector.—And be it enacted, that every person wilfully obstructing any person, duly authorized as aforesaid, in the execution of his duty, shall, on conviction before a justice of the peace having jurisdiction in the place where the offence shall have been committed, forfeit and pay for every such offence any sum not exceeding 10*l.*; and on default of payment of any penalty so adjudged, immediately or within such time as the said justice of the peace shall appoint, the same justice, or any other justice having jurisdiction in the place where the offender shall be or reside, may commit the offender to prison for any period not exceeding three calendar months, such commitment to be determined on payment of the amount of the penalty; and every such penalty shall be returned to the next ensuing court of quarter sessions in the usual manner.

Copies of existing bye-laws to be laid before the board of trade; otherwise to be void.—And whereas many railway companies are or may hereafter be empowered by Act of Parliament to make bye-laws, orders, rules, or regulations. and to impose penalties for the enforcement thereof, upon persons other than the servants of the said companies, and it is expedient that such powers should be under proper control; be it enacted, that true copies of all such bye-laws, orders, rules, and regulations made under any such powers by every such company before the passing of this Act, certified in such manner as the lords of the said committee shall from time to time direct, shall, within two calendar months after the passing of this Act, be laid before the lords of the said committee; and that every such bye-law, order, rule, or regulation, not so laid before the lords of the said committee within the aforesaid period, shall, from and after that period, cease to have any force or effect, saving in so far as any penalty may have been then already incurred under the same.

No future bye-laws to be valid till two calendar months after they have been laid before the board of trade.—And be it enacted, that no such bye-law, order, rule, or regulation made under any such power, and which shall not be in force at the time of the passing of this act, and no order, rule, or regulation annulling any such existing bye-law, rule, order, or regulation which shall be made after the passing of this Act, shall have any force or effect until two calendar months after a true copy of such bye-law, order, rule, or regulation, certified as aforesaid, shall have been laid before the lords of the said committee, unless the lords of the said committee shall, before such period, signify their approbation thereof.

Board of trade may disallow bye-laws.—And be it enacted, that it shall be lawful for the lords of the said committee, at any time either before or after any bye-law, order, rule, or regulation shall have been laid before them as aforesaid shall have come into operation, to notify to the company who shall have made the same their disallowance thereof, and in case the same shall be in force at the time of such disallowance, the time at which the same shall cease to be in force; and no bye-law, order, rule, or regulation which shall be so disallowed shall have any force or effect whatsoever, or, if it shall be in force at the time of such disallowance, it shall cease to have any force or effect in the time limited in the notice of such disallowance, saving in so far as any penalty may have been then already incurred under the same.

Provisions of Railway Acts requiring confirmation of bye-laws repealed.—And be it enacted, that so much of every clause, provision, and enactment in any Act of Parliament heretofore passed as may require the approval or concurrence of any justice of the peace, court of quarter sessions, or other person or persons, other than members of the said companies, to give validity to any bye-laws, orders, rules, or regulations made by any such company, shall be repealed.

Board of trade may direct prosecutions to enforce provisions of Railway Act. Notice to be given to the company.—And be it enacted, that whenever it shall appear to the lords of the said committee that any of the provisions of the several Acts of Parliament regulating any of the said companies, or the provisions of this Act, have not been complied with on the part of any of the said companies, or any of their officers, and that it would be for the public advantage that the due performance of the same should be enforced, the lords of the said committee shall certify the same to her Majesty's attorney-general for England or Irelaad, or to the lord advocate for Scotland, as the case may require; and thereupon the said attorney-general or lord advocate shall, by information, or by action, bill, plaint, suit at law or in equity, or other legal proceeding, as the case may require, proceed to recover such penalties and forfeitures, or otherwise to enforce the due performance of the said provisions, by such means as any person aggrieved by such non-compliance, or otherwise authorized to sue for such penalties, might employ under the provisions of the said acts: provided always, that no such certificate as aforesaid shall be given by the lords of the said committee until twenty-one days after they shall have given notice of their intention to give the same to the company against or in relation to whom they shall intend to give the same.

Prosecutions to be under sanction of board of trade, and within one year after the offence.—And be it enacted. that no legal proceedings shall be commenced under the authority of the lords of the said committee against any railway company for any offence against this act, or any of the several Acts of Parliament relating to railways, except upon such certificates of the lords of the said committee as aforesaid, and within one year after such offence shall have been committed.

Punishment of servants of railway companies guilty of misconduct.—And be it enacted, that it shall be lawful for any officer or agent of any railway company, or for any special constable duly appointed, and all such persons as they may call to their assistance, to seize and detain any engine-driver, guard, porter, or other servant in the employ of such company, who shall be found drunk while employed upon the railway, or commit any offence against any of the bye laws, rules, or regulations of such company, or shall wilfully, maliciously, or negligently do or omit to do any act whereby the life or limb of any person passing along, or being upon the railway belonging to such company, or the works thereof respectively, shall be, or might be injured or endangered, or whereby the passage of any of the engines, carriages, or trains shall be or might be obstructed or impeded, and to convey such engine-driver, guard, porter, or other servant so offending, or any person counselling, aiding, or assisting in such offence, with all convenient despatch, before some justice of the peace for the place within which such offence shall be committed, without any other warrant or authority than this act; and every such person so offending, and every person counselling, aiding, or assisting therein as aforesaid, shall, when convicted before such justice as aforesaid, (who is hereby authorised and required upon complaint to him made, upon oath, without information in writing, to take cognizance thereof, and to act summarily in the premises), in the discretion of justice, be imprisoned, with or without hard labour, for any term not exceeding two calendar months, or, in the like discretion of such justice, shall for every such offence forfeit to her Majesty any sum not exceeding 10*l.*, and in default of payment thereof shall be imprisoned, with or without hard labour as aforesaid, for such period, not exceeding two calendar months, as such justice shall appoint; such commitment to be determined on payment of the amount of the penalty; and every such penalty shall be returned to the next ensuing court of quarter sessions in the usual manner.

Justice of the peace empowered to send any case to be tried by the quarter sessions.—Provided always, and be it enacted, that (if upon the hearing of any such complaint he shall think fit) it shall be lawful for such justice, instead of deciding upon the matter of complaint summarily, to commit the person or persons charged with such offence for trial for the same at the quarter sessions for the county or place wherein such offence shall have been committed, and to order that any such person so committed shall be imprisoned and detained in any of her Majesty's gaols or houses of correction in the said county or place in the mean time, or to take bail for his appearance, with or without sureties, in his discretion; and every such person so offending, and convicted before such court of quarter sessions as aforesaid (which said court is hereby required to take cognizance of and hear and determine such complaint), shall be liable, in the discretion of such court, to be imprisoned, with or without hard labour, for any term not exceeding two years.

Punishment of persons obstructing railway.—And be it enacted, that from and after the passing of this Act every person who shall wilfully do or cause to be done any thing in such manner as to obstruct any engine or carriage using any railway, or to endanger the safety of persons conveyed in or upon the same, or shall aid or assist therein, shall be guilty of a misdemeanor, and being convicted thereof shall be liable, at the discretion of the court before which he shall have been convicted, to be imprisoned, with or without hard labour, for any term not exceeding two years.

For punishment of persons obstructing the officers of railway company, or trespassing upon any railway.—And be it enacted, that if any person shall wilfully obstruct or impede any officer or agent of any railway company in the execution of his duty upon any railway, or upon or in any of the stations or other works or premises connected therewith, or if any person shall wilfully trespass upon any railway, or any of the stations or other works or premises connected therewith, and shall refuse to quit the same upon request to him made by any officer or agent of the said company, every such person so offending, and all others aiding or assisting therein, shall and may be seized and detained by any such officer or agent, or any person whom he may call to his assistance, until such offender or offenders can be conveniently taken before some justice of the peace for the county or place wherein such offence shall be committed, and when convicted before such justice as aforesaid (who is hereby authorized and required, upon complaint to him upon oath, to take cognizance, thereof, and to act summarily in the premises,) shall, in the discretion of such justice, forfeit to her Majesty any sum not exceeding 5*l*, and in default of payment thereof shall or may be imprisoned for any term not exceeding two calendar months, such imprisonment to be determined on payment of the amount of the penalty.

Proceedings not to be quashed for want of form, or removed into the superior courts.—And be it enacted, that no proceedings to be had and taken in pursuance of this Act shall be quashed or vacated for want of form, or be removed by certiorari, or by any other writ or process whatsoever, into any of her Majesty's courts of record at Westminster or elsewhere, any law or statute to the contrary notwithstanding.

Repeal of all provisions in railway Acts that empower two justices to decide disputes respecting the proper places for openings in the ledges or flanches of railways.—And whereas many railway companies are bound, by the provisions of the Acts of Parliament by which they are incorporated or regulated, to make, at the expence of the owner or occupier of lands adjoining the railway, openings in the ledges or flanches thereof (except at certain places on such railway in the said Acts specified), for effecting communications between such railway and any collateral or branch railway to be laid down over such lands, and any disagreement or difference which shall arise as to the proper places for making any such openings in the ledges or flanches is by such Acts directed to be referred to the decision of any two justices of the peace within their respective jurisdictions: and whereas it is expedient that so much of every clause, provision, and enactment in any Act of Parliament heretofore passed, as gives to any justice or justices the power of hearing or deciding upon any such disagreement or difference as to the proper places for any such openings in the ledges or flanches of any railway, should be repealed; be it therefore enacted, that so much of every such clause, provision, and enactment as aforesaid shall be repealed.

Board of Trade to determine such disputes in future.—And be it enacted, that in case any disagreement or difference shall arise between any such owner or occupier, or other persons, and any railway company, as to the proper places for any such openings in the ledges or flanches of any railway (except at such places as aforesaid), for the purpose of such communication, then the same shall be left to the decision of the lords of the said committee, who are hereby empowered to hear and determine the same in such way as they shall think fit, and their determination shall be binding on all parties.

Communications to the board to be left at their office.—Communications by the board how to be authenticated. What shall be deemed good service on railway company.—And be it enacted, that all notices, returns, and other documents required by this Act to be given to or laid before the lords of the said committee shall be delivered to or sent by the post to the office of the lords of the said committee; and all notices, appointments, requisitions, certificates, or other documents in writing, signed by one of the secretaries of the said committee, or by some officer appointed for that purpose by the lords of the said committee, and purporting to be made by the lords of the said committee, shall, for the purposes of this Act, be deemed to have been made by the lords of the said committee; and service of the same upon any one or more of the directors of any railway company, or on the secretary or clerk of the said company, or by leaving the same with the clerk or officer at one of the stations belonging to the said company, shall be deemed good service upon the said company.

Meaning of the words "railway" *and* "company."—And be it enacted, that wherever the word "railway" is used in this Act it shall be construed to extend to all railways constructed under the powers of any Act of Parliament, and intended for the conveyance of passengers in or upon carriages drawn or impelled by the power of steam or by any other mechanical power; and wherever the word "company" is used in this Act it shall be construed to extend to and include the proprietors for the time being of any such railway, whether a body corporate or individuals, and their lessees, executors, administrators, and assigns, unless the subject or context be repugnant to such construction.

Act may be repealed this session.—And be it enacted, that this Act may be amended or repealed by any Act to be passed in the present Session of Parliament.

THE THAMES EMBANKMENT.

ABRIDGEMENT OF THE EVIDENCE.

(Concluded from p. 360.)

Mr. *Stephen Leach* stated, that he is clerk of the works on the river Thames, from Staines to Yantlet Creek; 39 years in all he has been in the service of the corporation; nine years assistant to his predecessor, and 30 years since. Very considerable improvements have taken place under his direction in the navigation of the Thames between Putney and Staines; when he came into the office, the navigation there was in a very bad state; it was no unusual thing for 50 or 60 barges to be aground in one place, and some of them he has known to be a fortnight working through the city jurisdiction. At present they get up with tolerable certainty, from the Pool to Staines, in 16 or 18 hours, and down from that place in less time; those improvements have been made under his direction. The improvements consist of the building of six pound-locks and five weirs, in different places, where the impediments were the greatest; the removal of a number of shoals, and the raising of towing-paths with the ballast so removed. He has considered the plan now before the Committee for embanking the river Thames from Vauxhall Bridge to London Bridge, on the north side; he considers it certainly as calculated to effect an indispensable improvement, by a very obvious and usual mode of improving river navigation, namely, by contraction; it is much too wide in several places to preserve a uniform depth, and a convenient one for navigation. The object of this embankment would be to equalize the section of the river, to regulate the velocity, and thereby to displace and enclose the large quantities of mud which are at present on the shores, and which receive the noxious contents of the sewers. The embankment begins at Vauxhall Bridge, where there is a short length, not very important. With regard to the navigation that joins from Vauxhall Bridge to Millbank, opposite the Penitentiary, there the embankment is complete, which is carried out to the full extent; there is no intention in that part of carrying it further out; he considers it as a specimen of what the embankment would be if it were continued in a similar way. The line is taken to the Horseferry-road, Horseferry-stairs, in front of the Marquess of Westminster's property; that would be a very beneficial improvement in his opinion. No part of that is embanked at present; the proposition is, to come flush with a very old wharf, which has been there for many years, now in the possession of Mr. Johnson, a stone wharf, in a line with the embankment at the Parliament Houses, which completes it to Westminster Bridge; below Westminster Bridge the embankment is proposed to be continued to Scotland-yard; and there, on account of the particular nature of the business, and the number of coal barges, it is proposed to discontinue the embankment, and adopt a low embankment of some two or three feet above low water, so as to form a dock for the more convenient carrying and entering those barges; that is Mr. Walker's plan, and it is one in which he (Mr. Leach) quite concurs. according to the present occupation. From Scotland-yard, in front of the Hungerford Market estate, the York-buildings' estate, the Savoy, and so on, he thinks there is a length of about 1,400 feet, and an average width of about 300 feet; the mud on part of this ground is already so grown up as to have a pretty large vegetation upon it in front of York-buildings, already embanked with an accumulation of mud. From Waterloo Bridge the embankment is proposed to be continued in front of Somerset House and King's College, about 600 feet in length, and an average width of 130 feet; and at no place, in his opinion, is an embankment so much needed as in front of Somerset House, where there is a very lofty heavy pile of building immediately on the brink of the river, and he thinks it wants something to defend it in front of it, which would be a protection to the building; there is a depth of water in front of it, at the upper end of it particularly; the set of the current is immediately in that direction: that violent current has so deepened the water at Waterloo Bridge, that the late Sir Edward Banks recommended a deposit of about 3,000 tons of stone to protect the Bridge. From King's College the embankment proceeds about 460 feet in length, with an average width of about 190 feet to Water-street, from whence, the occupation of the wharfs being principally by coal merchants, the open-dock system of low wharfing is proposed; there must be an open dock there to accommodate the coal trade; then the embankment would be continued to the end of Temple Gardens; it is then intended to adopt the open-dock system and the low wharfing below the Temple, from Whitefriars-dock to Blackfriars Bridge. There is nothing particular between Blackfriars and Southwark Bridges, only to correct the present irregularities, and make a fair and straight line. It goes on to London Bridge; at the bridge it wants no contraction whatever, it is already quite small enough.

Mr. *James White Higgins* was examined; he is a surveyor of long standing; has been engaged both in the service of the Commissioners of Woods and Forests, and of the City of London, on very many occasions. The quantity of land to be embanked is 595,400 feet, that is, reclaimed by solid embankment; that I have from Mr. Walker's estimate, and that is independent of the Crown property. The amount of Crown property is 436,150 feet. With reference to value, it is an exceedingly difficult question to deal with, and one that does not often occur; and as practice and experience are the best test of value, he has felt a good deal of difficulty in dealing with it. He has made it a matter of inquiry, and having had a great deal to do with wharf property, perhaps more than most professional persons he has endeavoured to bring the experience he possesses and the information he could gain to bear upon the subject: the conviction of his mind is, that 2*d*. a superficial foot, which was talked of, the property could not bear; he thinks it would be excessive; but he thinks 1*d*. a foot superficial might be borne, which would yield nearly 2,500*l*. per annum upon the solid embankment; he thinks so, as he has already stated, from the experience he has, from the advantages it is calculated to afford. It involves the improvement of the navigation of the river, which the persons using the wharfs would be benefited by; it gives them an increased quantity of freehold property; and with regard to that freehold property, if, as was done in a former case, he believes, and that to some considerable extent, at the time of building Blackfriars Bridge, the freehold property was made also free from rates and taxes, it would afford another advantage. That property so reclaimed at Blackfriars Bridge was charged at 1*d*. a foot, he finds; as far as he has been able to learn, it was found to work well; and one advantage that would be afforded here is, that in some cases persons with bad wharf walls would get good ones. In other cases, the general property would be secured by this embankment, and a great public highway, the Thames, would be benefited, and persons using it. Persons possessing themselves of freehold land, he thinks, would have no just ground of complaint in paying 1*d*. a foot for the property reclaimed; but there would be this difficulty about it, and one which the honourable Committee will feel perhaps to be considerable, a penny a foot on some portion of the property would be much too little, and on others it would be too much; in some cases persons would get the more valuable part of the property in Thames-street; he knows that they would be very glad to pay 2*d*. a foot; but in other cases he knows persons would not be willing to pay a penny per foot. The honourable member for Lambeth has alluded to cases in which the advantages now possessed by individuals would be lessened. Those points all want consideration. Every individual case, to do what he is quite sure the Committee are desirous to do, viz. to do justice, would require a matter of consideration; that is an affair which he has not entered upon except in this way, he has judged from his own experience. He has valued a good deal of wharf property; he has lately had to buy a good deal for the Crown at the enormous price that was invariably asked; we were then told that a few feet were worth nobody knows what money. He has also had to value with reference to a good deal of the parish assessments along the river, Hungerford Market and other parts; now he is quite satisfied that in some cases it would be an extraordinary boon at a penny per foot; but in others 1*d*. per foot could not be borne. How the separate cases are to be met he must leave to the Committee; but, in going from wharf to wharf, (he does not mean the Committee to understand that he has been on every wharf, he has been on many), he has put down what each wharf would bear, and that comes nearly to 1*d*. per foot, so that he feels warranted in saying that 2,500*l*. a year might be charged for the whole line of embankment, from one extremity to the other, where a solid embankment exists; but it is a matter of considerable difficulty. He has endeavoured to do it as honestly and impartially as he could, and bring all the experience which he has to the subject. Then as regards the dwarf piling, that is 725,700 feet; the superficial quantity enclosed by the dwarf piling, a halfpenny per foot has been talked of for that; he has more difficulty in this than in the other case, in saying what is right. There are advantages with reference to the navigation and security of buildings, and the possession of freehold instead of what, so far as he has heard of the evidence, appears to be a doubtful property, the city claiming a right over it, which would be abandoned, he takes it, in this case. But he has not, as in the case of Blackfriars Bridge, any test here, and after thinking of it a good deal, he has taken an annual sum for it of 1,133*l*., that is, between a halfpenny and a farthing, the intermediate sum, as an annual sum; a halfpenny per foot was mentioned; he thought it too much, for it gave larger rent in some places than it appeared to me they could bear, though they have advantages in this case; by becoming their own freehold they would have a right to embank at any future period; but it is a matter of so much difficulty, that to give his evidence as he could upon some subjects, to say that he knows from experience that the property would produce such results, he could not pretend to do. It is open to much doubt. His impression is, that in both cases he has been moderate; he intended to be so. It would be worth to sell, twenty-five years' purchase. He would not be warranted in putting it at 25 years' purchase unless it was connected with the other portions of the property. Freehold land connected with buildings is generally at 20 years' purchase only. A ground-rent, amply secured, has sold for 30 or 31 years' purchase. This is an intermediate case of 25 years' purchase. He thinks 30 years would be too much, as there is some speculation in it, or else it is a ground-rent, and therefore he thought 25 was safer.

The following is the Report of Mr. Walker made in 1821, referred to in his evidence given in the last month's Journal.

"From the recent, and, we believe, accurate surveys that have been made, it appears that the difference of level in the water above and below bridge, towards the latter end of the ebb of a spring tide, is from 4 feet 4 inches to 5 feet 7 inches; the water is therefore at present dammed up to that extent at the bridge; we find, by calculation, that this pen will be reduced from, say 5 feet, to about 3 inches, by the proposed alterations; and the water above bridge, at low water, will therefore be 4 feet 9 inches lower than at present. But as the velocity of the stream above bridge will be increased by a greater quantity of water having to run through in the same time, both on account of the water flowing higher at high water, and ebbing lower at low water, the inclination of the surface will also be increased; and this lowering of 4 feet 9 inches, above referred to, will decrease as the distance from the bridge increases. Now, by the survey above referred to, the present rise in the surface of the water from London Bridge to Westminster Bridge, at low water, is 12 inches, being 6 inches, per mile; and supposing the velocity, after the alterations, to be increased so as to produce twice the inclination, or 12 inches per mile, the surface of the water at Westminster Bridge will be lowered, at low water, 4 feet 9 inches, less one foot (the increase of fall), or 3 feet 9 inches below its present level at spring tides. Again, from the best information we can collect, the rise of surface from Westminster to Fulham is about 8 inches per mile; and as the effect of the alterations of London Bridge will be less sensibly felt here than nearer the bridge, we assume that the inclination, after the alterations, will be 12 inches per mile, and the distance being nearly 6 miles, the water at Fulham will be lowered at low water 3 feet 9 inches less 2 feet, or 1 foot 9 inches, which will increase as we descend towards Westminster Bridge, when (as before stated) the depression will be 3 feet 9 inches. Again, as at Fulham, the surface will be lowered 1 foot 9 inches, this depression will decrease upwards; but as in any given length upwards, the effect of the proposed alterations will also decrease, this depth (1 foot 9 inches) will be felt a considerable way up the river; for we think it probable that the effect of the alterations may be sensible, in point of the navigation, for 6 miles above Fulham Bridge, or at Kew Bridge; and that though it will really extend higher, we apprehend that its effects will not be of any consequence above that point. We believe there is no speculation in any of the above numbers, excepting in the assumed increase of declination of surface; for the correctness of which we cannot vouch, but we have been guided by the consideration that 4 feet 9 inches at low water, and about 9 inches at high water, making together 5 feet 6 inches, will be added to the depth of water which will pass through the bridge at every spring tide; and by allowing an increase of fall in proportion to the square of the increase of velocity or quantity, and also by referring to the inclination in the upper part of the river, say between Mortlake and Teddington, as shown upon Mr. Whitworth's survey, and making such allowance as from the difference of situation appeared to us reasonable, we apprehend that we are not far from being correct, particularly between Fulham and London Bridge; and it is hardly necessary, after the above, to say that we agree in opinion with Mr. Smeaton, that, by this reduction of fall at the bridge, 'the navigation of that part of the river will be materially affected.' It appears to us, from our own knowledge, and from the statements that have been given to us, that although the increased velocity of the river would have a tendency to restore the river to its ancient depth, and in course of time would probably effect that object, yet that so great a lowering at once would be productive of great temporary inconvenience, unless artificial means were resorted to, to deepen the shoals, which, even in the present state of the river, are attended with considerable hindrance to the navigation. Mr. Smeaton's opinion on this subject goes beyond our ideas of time; but, as great respect is due to his opinion, we extract it in his own words: 'If this difference of bed,' that is, the difference above and below bridge, 'is original, we must expect it to remain after the bridge is taken away; but if an effect, the cause being removed, the river would gradually restore itself; but as this might probably take up 700 or 800 years (the time it has probably been gathering), the work of restitution would go on far too slowly to answer the demands of the present generation.' Our opinion is, that the difference of level in the bottom of the river, above and below bridge, is caused, in a great measure, by the pen of the bridge; and although we think that the work of restitution would be complete in less time than stated by Mr. Smeaton, unless where the accumulation has got cemented into a solid mass, which we have no doubt is in many places the case, yet, both for the purposes of present trade, and to prevent the shoals from being moved down the river by the current, and forming obstructions lower down the river or below bridge, we think that ballasting to a great extent will be expedient and requisite; as, in addition to the above reason, the stuff that is excavated from the upper part may be applied to raise the towing-paths and banks, so as to meet the increased height of the high water, which will occasionally be from 1 to 2 feet above the present level. One principal shoal is close above London Bridge, on the Surrey side; it extends almost half-way across the river, and is even now occasionally above low water. This must therefore be deepened to a considerable extent; and to prevent the opening of any of the proposed widened arches, which will be opposite to it, from washing any part of it into the Pool, and settling upon the shoals below bridge, it, as well as the other shoals, ought to be ballasted away before the proposed arches are opened. In regard to the navigation through London Bridge, we are of opinion that it will be very essentially improved by the proposed alterations, and that the cause of the losses, accidents, and dangers to which the passage is at present subject, from the great fall or shoot in the arches, will be almost entirely removed. We have mentioned, that the velocity of the current above bridge will be increased. This will take place during both the flood and ebb tide, but will be greatest in the latter; and the increase of velocity will, as before stated, be greatest between Westminster and London Bridges. In our calculation of the fall, we have supposed that the increase of velocity will amount to one-half of the present velocity. This will, in many cases, be important, not only as regards the velocity itself, (as to which it will sometimes be found of advantage to craft and sometimes probably otherwise), but as the water will ebb sooner from all the wharfs, the time in each tide during which the barges are afloat at the wharfs and when they can float to and from them, will be decreased. This will, so far, be a disadvantage, but will occur only during the ebb of tide. It is evident, however, that it will not be compensated by the increased velocity of the flood-tide bringing the barges sooner to the wharfs above bridge, as the velocity of the flood will not be so much increased as that of the ebb-tide, and although barges may come up opposite to the wharfs sooner in the tide than they do at present, if the channel is deep enough, they will not be able to get close to the wharfs until about the same time of tide they do at present, unless a general artificial deepening takes place opposite to each wharf. In some cases, however, barges which may get opposite to the wharfs early in the tide, will be enabled by having done so to draw in to the wharfs so soon as there is depth enough of water to float them in, and, so far as this goes, the effect of this proposed alteration will be useful. The great cause of shoals is the unequal velocity of currents, and this inequality increases as the velocity increases; for therefore it is that floods, or great velocities, are always found to add to the shoals of navigable rivers, and to deepen what was too deep before. The increased current through the narrow parts disturbs and carries down the materials of the bottom through those narrow parts or deeps, and they are lodged upon the shoals below, where the decreased velocity, caused by the widening of the river, has not force enough to carry them along with it. There can be no more striking illustration of this general theory, than the effect of floods upon the river near London Bridge, which is invariably to deepen between the arches, and at the same time to raise the shoals below the bridge; therefore, although the natural effect of the increase of current is upon the whole to deepen its channel, it does it so partially that it has also the effect, in rivers of unequal current, such as the Thames is, of forming and increasing shoals, and unless guarded against by proper means may therefore be injurious to the navigation. Now the effect of opening London Bridge will be, that the ebb-tide and land-floods, not being checked by the pen of London Bridge, will increase in velocity to the extent *up the river* that the effects of this pen are felt, and produce the consequences we have mentioned, so that an increase of expense in deepening the shoals after floods, and a greater inequality of level in the bottom, will be the consequence, and this will be a lasting expense unless means are taken to prevent it. The means we should recommend are, the nearer approximation to an *uniform velocity*, which would best be accomplished by producing an *equality of area*, such as contracting the *width* of the river abreast of the shoals, *by means of embankments or otherwise:* as this cannot, however, be done in many places to the required extent without enormous expense, ballasting must be had recourse to until a new regimen corresponding to the existing circumstances is obtained. Finally, although we think it might have been desirable that the great change, which the proposed opening of the arches in London Bridge will certainly produce in the navigation, had been made, so that their effects might have been felt, and things conformed to the new state by degrees, yet when called upon to give an opinion without these experiments, we feel little hesitation in saying that if effectual means are taken for preventing the evils to which we have referred, then the proposed alterations will be beneficial to the navigation above bridge, but that without those effectual means they will be injurious."

Now, the fact is, that the alterations have been made to the full extent stated in this report, and the consequences have been to the full extent of what is stated, but as yet no means have been taken to remove the evil which was anticipated, and is now felt.

A Statement showing the Sectional Areas of the River Thames, taken in the Years 1823 and 1831.

—	No. 7. Sections.	Sectional Area of the Tidal Water below Trinity High-water Mark.		Difference in 1831.	Sectional Area below Low-water Mark.		Difference in 1831.	Total Sectional Area of the River Thames below Trinity High-water Mark.		Difference in 1831.]
		By Survey of 1823.	By Survey of 1831.		By Survey of 1823.	By Survey of 1831.		By Survey of 1823.	By Survey of 1831.	
		Sup.Feet.	*Sup.Feet.*		*Sup.Feet.*	*Sup.Feet.*		*Sup.Feet.*	*Sup.Feet.*	
About 230 yards north of Westminster Bridge . . .	4	15,409	16,559	increase 1,150	3,939	3,487	decrease 452	19,348	20,046	increase 698
Near King's Arms Stairs and Whitehall Stairs	5	16,411	17,090	ditto 679	4,757	6,570	increase 1,813	21,168	23,660	ditto 2,492
Near Hungerford Stairs . .	6	16,083	17,902	ditto 1,819	3,891	3,920	ditto 29	19,974	21,822	ditto 1,848
Near Waterloo Bridge . . .	8	16,818	16,958	ditto 140	3,752	3,947	ditto 195	20,570	20,905	ditto 335
Opposite Bouverie Street . .	11	13,959	14,310	ditto 351	4,332	3,900	decrease 432	18,291	18,210	decrease 81
Between Blackfriars and Southwark Bridge	13	12,982	13,822	ditto 840	3,976	3,381	ditto 595	16,958	17,203	increase 245

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

INSTITUTION OF CIVIL ENGINEERS.

April 14.—The PRESIDENT in the Chair.

"*Description of a Dynamometer, or an Instrument for measuring the Friction on Roads, Railways, Canals, &c.*" By Henry Carr, Grad. Inst. C.E.

The object of Mr. Carr's modification of the dynamometer is to obviate the irregularity of the common indicator arm, caused by the jerking motion of the tractive power or any inequality of resistance. The instrument consists of a cylinder half filled with mercury, and containing a piston connected with the spring of the dynamometer, so as to be lowered or raised as the tractive power is increased or diminished. Two tubes of glass, connected by a passage with a regulating valve, stand in front of the cylinder, one of them communicating freely with it, and in this tube the mercury is raised or lowered proportionally to the power applied; while in the other, an average of the variations is obtained as the facility of communication between the tubes is increased or diminished by the opening or closing of the stop-valve. The instrument must be graduated by actual experiment, and the results of the average power may be read off from the scales placed behind the tubes. The paper is illustrated by a detailed drawing of the machine.

"*An account of a proposed Suspension Bridge over the Haslar Lake at Portsmouth.*" By Andrew Burn, Jun., Grad. Inst. C. E.

The usual calculation for the maximum load on each superficial foot of the platforms of suspension bridges is 70 lb.; but, as in the event of a crowd of persons assembling the pressure may increase to nearly 100 lb. per foot, and by the passage of soldiers marching in regular time the strain may be greatly augmented, the projector assumed 200 lb. per superficial foot as the amount of load to which the platform might be subjected. The peculiar feature of this bridge is the substitution of cast-iron chains for the wrought-iron ones generally used. This deviation from the usual practice is adopted as a measure of economy, and with a view of increasing their stability and durability, cast-iron being much less influenced by atmospheric action than wrought-iron. Cast-iron beams, when well proportioned, will bear a very considerable tensile strain. As these chains would be proved beyond the weight they are intended to bear, no doubt is entertained by the author of their security. The platform, which is formed of transverse iron girders carrying cast-iron plates ¾ of an inch thick, with dovetails falling into holes cast in the girders, is suspended by wrought-iron rods 1½ inch square from two lines of chain only, as the strain is more easily brought to bear on them than on a greater number of chains. They are trussed laterally to prevent oscillation, and the balustrade is so constructed as to prevent the undulation so prejudicial to suspension bridges generally. To insure a perfect bearing, each pair of links of the chains are in manufacturing cramped together, and the holes bored out to receive the pins which are turned to fit them accurately; they are of a larger size than usual, being 4 inches diameter, and a less number are employed. The piers on which the chains pass are of cast-iron, 33 feet high above the level of the roadway.

	Feet.
The extreme length of the bridge is	632
The breadth of the roadway	17½
The clear waterway between the piers . . .	300
The clear headway of the platform above the high water line	18½
Ditto ditto above low water line . .	33

The tension on the chains is calculated as equal to 991·4143 tons. To sustain this tension, the section of the chains is 256 square inches, and taking 7 tons per square inch as the elastic limit of cast-iron, the resistance of the chains will equal 1792 tons, leaving a surplus of 800·6 tons after the calculated strain has been deducted from the real strength of the chains. Three elaborate detailed drawings accompany this paper.

Mr. Smith, of Deenston, *explained a new system of Lockage for Canals proposed by him, a model of which he presented to the Institution.*

To avoid the present expensive construction of locks and their waste of water, the author proposes to divide the canal into a series of basins, the water levels of which should be from 12 to 18 inches above each other. The extremity of each basin is so contracted as to permit only the free passage of a boat; in this is placed a single gate, hinged to a sill across the bottom, the head pointing at a given angle against the stream, and the lateral faces pressing against rabbets in the masonry. The gate is to be constructed of buoyant materials, or made hollow so as to float and be held up by the pressure of the water in the higher level; on the top is a roller to facilitate the passage of the boats. When a boat is required to pass from a higher to a lower level, the bow end, which must be armed with an inclined projection, depresses the gate as much as the depth of the immersion of the boat, and as much water escapes as can pass between its sides and the walls of the contracted part of the basin. The same action takes place in ascending, except that a certain amount of power must be expended to enable the boat to surmount the difference of level between the basins. The quantity of water wasted by each boat would be in proportion to its immersion and the speed at which it passed over the gate. In case of different sized boats passing along the same canal, it is proposed to have a small gate forming part of the main gate, so as to avoid the loss of water which would ensue from the whole width being open for the passage of a small boat.

This system has only been tried by models; but it is proposed to make an essay on an extensive canal next summer, when the results will be communicated to the Institution.

May 5.—The President in the Chair.

The following were balloted for and elected :—Angier March Perkins, St. George Burke, and Beriah Botfield, as Associates.

"*Description of the Engines on board the Iron Steam Tug, the Alice.*" By J. Patrick, Inst. C. E.

The speed of this boat having far exceeded the constructor's expectations, induced the author to send a description of her proportions, and of the construction of the engines. The chief peculiarity in the engines is their being placed in the centre of the vessel, with the two cylinders in a line with the keel, and placed at an angle of 45°, inclining inwards towards the paddle shaft, to which the motion is communicated direct (without the use of side beams) by long connecting rods attached to the cross heads, which are placed at the lower ends of the cylinders, instead of being on the top as in the usual manner; the connecting rods are thus enabled to be three times instead of twice the length of the stroke, as is usually the case. The framing is entirely of wrought-iron on the tension principle, and appears to resist the tendency to vibration better than cast-iron framing. For the two cylinders of 31 inches diameter, there is only one air pump of 22½ inches diameter, with 19½ inches length of stroke, instead of the usual complement of two air pumps, 18 inches diameter each; this is found to be sufficient, as a vacuum of 13¾ lb. per square inch is maintained. One of the advantages proposed by this mode of construction is the reduction of weight; these engines only weighing 9 cwt. per horse power. The small space occupied leaving more room for passengers, they are particularly adapted for river navigation, where the breadth of beam must be limited. The simplicity of their construction renders them less liable to expensive repairs.

The principal proportions of the Alice are—

	Feet.	Inches.
Length between perpendiculars	95	
Breadth of beam	20	
Draft of water	4	6
Diameter of wheel	14	
Size of engines	two 30 horse power	
Diameter of cylinder	0	31 inches
Length of stroke	3	3

The engines were constructed by Messrs. Davenport and Grindrod, of Liverpool. Drawings of the boat and engines accompany this communication.

"*Description of an Apparatus for preventing the Explosion of Steam Boilers.*" By Robert M'Ewen.

The frequent explosions of steam boilers, caused in many instances by the steam being confined until it acquires a density greater than the boiler can resist, induced the author to invent a simple, self-acting apparatus, intended to warn the engineer whenever the pressure exceeded the proper degree of safety.

The apparatus under consideration is constructed on the principle that steam, in proportion to its density, will support a column of water or mercury, of a given height, and that any fluid will find the same level in two or more vessels, provided there be a free communication between them. It may be called a mercurial safety valve, and consists of a cylinder, within which are two cups, with two pipes dipping into them of a length proportioned to the pressure of the steam; these pipes are connected at the top with two valves on one spindle, so arranged, as that when one is open the other must be closed. On the top is a waste steam pipe open to the atmosphere. One pipe being filled with mercury, and the valve connected with it being open, the mercury remains stationary until the pressure of the steam exceeds its proper point. It will then be blown out and fall into the empty cup, allowing the steam to escape by the waste pipe, and giving warning to the engineer by its noise. When the pressure is again reduced to its proper point the valve is reversed, and the mercury will, on the next occasion of an increase of pressure, be blown back again, still giving warning on either side.

Plans and sections of this apparatus accompanied the paper.

"*On setting out Railway Curves.*" By Charles Bourns, Assoc. Inst. C. E.

Mr. Bourns having been engaged in setting out the Taff Vale Railway through a country presenting circumstances of more than ordinary difficulty, which rendered it necessary to vary the radii and the flexure of the curves frequently, his attention was particularly directed to the subject; and he has treated it in this paper clearly and successfully, demonstrating the several cases geometrically, and generally in a plain and satisfactory manner. He calls attention to the inaccuracy of applying a square to the setting out of segmental curves, particularly those of short radii, and recommends an offset staff as theoretically correct and practically much more convenient. The general rule to find the offset is—"Divide the number of inches in the chain used by the number of such chains in the radius of the required curve, the quotient is the offset in inches." The paper is accompanied by a table of offsets for curves of different radii; which the author found extremely convenient for use in the field.

The paper being altogether mathematical is not adapted for publication in abstract; but it will be given at length, with examples and diagrams, in the Transactions of the Institution.

"*Description of an Instrument for describing the Profile of Roads.*" By Henry Carr, Grad. Inst. C. E.

The object of the author was the construction of a machine, which, being drawn along any road of moderately even surface, should describe the section of the line over which it passed. It is evident, that if a pendulum be suspended from a frame standing perpendicularly when the machine rests on a horizontal plane, on passing over a plane inclined at any angle with the horizon, the pendulum must form the same angle with the frame the tangent of which angle in terms of the radius will be the rise or fall of the plane. The duration of the tangent will be determined by the paper on which the section is drawn being made to traverse at a speed proportionate to the distance passed over; and the extent, by the difference of the speeds of a nut and screw which are made to revolve in the same direction—the nut turning at a constant velocity, and the screw at a speed differing from that of the nut in proportion to the tangent, slower or faster as the tangent is *plus* or *minus*, raising or lowering the nut according to the deviation of the plane from the horizontal line.

The machinery is set in motion by the wheels of the carriage, and a series of wheels and pinions of given diameters cause the ground line and datum line to be drawn simultaneously by two pencils on a paper which gradually unfolds itself from one drum, and is transfered to another at the rate of 16 inches per mile passed over, or on a scale of 5 chains to the inch. A profile of a line of country may thus be obtained with sufficient accuracy for a preliminary survey.

A comprehensive perspective drawing accompanies the paper, and explains the construction of the machine.

May 12.—The President in the Chair.

"*Photography, as applicable to Engineering.*" By Alexander Gordon, M. Inst. C. E.

The object of the author in this paper is to direct general attention to the advantages which may be expected to result to the profession of the Civil Engineer from the discoveries of Mons. Daguerre and others, in enabling copies of drawings, or views of buildings, works, or even of machinery when not in motion, to be taken with perfect accuracy in a very short space of time and with comparatively small expense. This system of copying not only the outline, but the tints of light and shade, united with accurate linear perspective, he contends may be easily adapted to the purpose of the engineer, as well as to all those professions in which the art of drawing is used. The photographic apparatus has already been employed to bring before us exact copies of the most interesting monuments of antiquity, the French antiquarians and artists having found it more easy and correct to Daguerreotype the Egyptian monuments and decipher the hieroglyphics at their leisure, than to labour over the originals.

The subject is divided into two branches: the first being the art of copying drawings and plans by the transmission and absorption of light by prepared paper. The drawing to be copied is placed between two pieces of plate glass, held down in close contact with a sheet of photogenic paper, prepared by being washed over on both sides with a neutral solution of nitrate of silver of a spectfic gravity of 1·066, and afterwards with a solution of common salt and water (1℔. of salt to 25 pints of water). The paper thus prepared must be dried and kept in the dark, on account of its peculiar delicacy. The rays of the sun are then permitted to pass through the white portions of the drawing or print, while they are interrupted by the black lines, and more or less by the tinted portions. The rays of light thus act upon the prepared paper, and produce, in a few minutes, a reversed copy, reproducing the lights of the original in shadows; this can be remedied by taking a second copy from the first, and thus the shadows are restored to their original positions. To destroy the sensitiveness of the prepared paper, and preserve the copy, it is soaked in pure water, which carries off the excess of nitrate of silver, then covered with a solution of hypo-sulphite of soda of a specific gravity of 1,055, and again washed in pure water, so that when dried it is permanently fixed. It is evident that a copy thus obtained must be exactly like the original, and the value of such a process may be readily estimated by engineers.

The second branch, which is named "Daguerreotype," after the distinguished artist who brought it to its present state of perfection, is of a much higher order. This is the art of fixing and preserving on the surface of a polished silvered plate the images collected in the focal plane of a camera obscura.

The process is rather complicated, but may be thus briefly described. The surface of the silvered plate being cleaned and polished very perfectly by means of finely levigated pumice stone, olive oil, and cotton, is rubbed lightly over with diluted nitric acid, in the proportion of 1 pint of acid to

16 pints of distilled water; it is then subjected to the heat of charcoal or a spirit lamp until a firm white coating is formed all over the surface of the silver. The plate is then suddenly cooled. This process is repeated three times. It is placed in a dark chamber with the face or silver surface downwards, where it is acted upon by the spontaneous evaporation of iodine; this condenses upon the silver, and produces a fine gold-coloured surface, extremely sensitive to the impressions of light. It is then placed in a camera obscura, the light having been until then perfectly excluded from it. It there receives the impression of any images brought within the focal plane; and by subsequently exposing it in a dark, close chamber, with its silver surface downwards, to the fumes of heated mercury, the images are rendered visible; to fix the images so received, the iodine is removed by dipping the plate in pure water, and then washing it either with a weak solution of hypo-sulphite of soda or a saturated solution of common salt, and finally dipping it in distilled water and drying it. It should then be framed and glazed to preserve it from external injury, and the picture will remain unchanged.

Attempts have been made to use this process for preparing the plates for engravers, as much time and cost would thereby be saved, but hitherto it has not been done to any extent.

The author presses upon the Institution the applicability of these processes to engineering uses, and quotes the remark of Mons. Arago—"That photographic delineations having been subjected during their formation to the rules of geometry, we may be enabled, by the aid of a few simple data, to ascertain the exact dimensions of the most elevated parts of the most inaccessible edifices."

Mr. Cooper, Senior, introduced the subject of photography by explaining, and illustrating by instruments and diagrams, the principles of the division and dispersion of the rays of light, according to the Newtonian theory, as well as the most recent researches into the subject. He described the chemical properties of light—its affinity for certain combinations, such as chloride of silver—its heating powers—the different effects of the rays on vegetation—and the application of these known principles to photography. He then explained the chemical properties of the chloride of silver, iodine, and other substances used in the process. In alluding to the probable uses of the Daguerreotype, he observed that the process might be employed to make drawings of machinery, as graduated scales might be fixed to certain parts of the objects, and they would be copied in their relative proportions to the machine.

Mr. Cooper, Junior, illustrated Mr. Gordon's communication by explaining the photographic apparatus, and the process of obtaining a specimen of Daguerreotype by means of the oxy-hydrogen light. He described, among other points, the difficulty of obtaining pure silver upon the copper plates, as, for the advantage in rolling, the manufacturer will introduce an alloy of ½ to 1½ per cent. On this account, acid is used so repeatedly in cleaning the plates, that any particles of copper which have been rolled into the surface may be carried off. He explained his improvement to the iodine box, which consists in spreading the iodine all over the bottom of a tray lined with glass, and covering it with a piece of card-board, which becomes saturated with the fumes of the iodine, and on the silvered plate being placed over it, acts equally over its surface, instead of partially, as in the old system of placing the iodine in a mass in the centre of the tray. He had found this to be a great improvement. The shortest time in which he had obtained a photographic picture in England was 11 minutes; while, during a gloomy day in November, it took an hour and a half to procure a moderately good one.

"*An Universal Screw-Jack.*" By George England.

This machine, a model of which was presented to the Institution, is intended for raising heavy weights and moving them in any required direction; the vertical motion is similar to that of a common screw-lifting jack, and the lateral motion is communicated by a ratchet lever to a horizontal screw, working in bearings on a strong cast-iron bed with planed surfaces through a double nut attached to the base of the jack. The jack has been found useful for erecting heavy pieces of machinery, and for replacing railway carriages and locomotives on the rails when they have been accidentally thrown off.

"*Description of a Traversing Screw-Jack.*" By W. J. Curtis.

The screw-jack is attached to a plank with a rack in it, and slides in a groove in another plank which is placed beneath it, across the railway; in the lower plank is a rack, by means of which and a hooked lever, the jack, with the engine or any other weight resting upon it, is drawn easily across the rails and lowered to its proper position. By this apparatus, engines and carriages of considerable weight have been replaced on a railway by two men in a very short space of time.

A model of the machine was presented to the Institution.

May 19.—The PRESIDENT in the Chair.

Peter Bruff was balloted for and elected an Associate.

"*Description of a new Gas Regulator.*" By James Milne.

The object of this instrument (which the inventor exhibited in action, and presented to the Institution) is to regulate the supply of gas to burners, so that any variation in the pressure, arising from extinguishing the adjacent lights along the line of the street main, or in the different floors of manufactories, shall not affect those lights which are supplied through the regulator.

The regulator consists of a cylindrical outer case, to which is affixed a water gauge to show the pressure; to the top is attached an inner cylinder, open at the lower end and reaching nearly to the bottom of the outer case; the gas is introduced from beneath by a tube in the centre, terminating in a conical valve at the top; the male part of the valve is fixed by three arms to the top of a float, which moves freely in the space between the inner cylinder and the centre tube; the areas between the outer case and the inner cylinder, and between the inner cylinder and the centre tube, being alike, the pressure of the gas acts upon the water within the inner cylinder, and causes it to rise in the outer case just as much as it is depressed in the inner space. This depression carries down the float with the male part of the valve attached to it, and thus diminishes the aperture of the supply pipe, until the pressure is relieved by other burners being lighted, and enables the supply of gas to be in proportion to the demand. The pressure may be regulated at will by increasing or diminishing the quantity of water in the cylinders, and it is shown correctly by the graduated glass gauge. This apparatus has been found, in an experience of two years, to effect a saving of about 20 per cent., independent of its ensuring a perfect equality to all the burners in action. Drawings of the instrument accompanied this communication.

Mr Lowe believed the "gas regulator" to be an efficient instrument. It was of the utmost importance that the light from gas should be steady and equal, as the nerves of the eye were more injured by an unsteady than by an intense light. In large establishments, the greatest care would scarcely prevent constant variation in the lights, so that an efficient means of producing regularity must be valuable.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

TENTH MEETING.—*September*, 1840.

(From the Athenæum.)

SECTION G.—MECHANICAL SCIENCE.

Mr. Dircks gave an account of *a railway wheel with wood tyre*, which was exhibited in the museum. It was one of a set which had been in use for two months, carrying five tons each day. The construction of the wheel will be understood by imagining an ordinary spoked wheel, but with a deep-*channelled* tyre. In this channel is inserted blocks of African oak, measuring about 4 × 3½ inches, prepared by filling the pores with such unctious preparations as counteract the effects of capillary attraction in regard to wet or damp. The blocks are cut so as to fit very exactly, with the grain placed vertically throughout, forming a kind of wooden tyre. There are about thirty blocks of wood round each wheel, where they are retained in their places by bolts, the two sides of the channel having corresponding holes drilled through them for this purpose; each block of wood is thus fastened by one or two bolts, which are afterwards well rivetted. After being so fitted, the wheel is put into a lathe, and turned in the ordinary manner of turning iron tyres, when it acquires all the appearance of a common railway wheel, but with an outer wooden rim, and the flange only of iron. Mr. Dircks proposes the use of either hard or soft woods, and of various chemical preparations to prevent the admission of water into the pores of the wood: he also contemplates the using of wood well compressed.

Mr. Jeffrey *on a New Hydraulic Apparatus.*—It comprised an improvement on the ancient endless chain of buckets, which he considers of Egyptian origin. This apparatus has hitherto never acquired the value it admits of, on account of a defect having remained in its construction, opposed to geometrical principle—the buckets which bring up the water being fixed outside instead of within the rope. The effect of this is such an acceleration of the bucket, when it is carried round the wheel at top, as causes it to overtake the water and carry much of it down again. But, by placing the buckets on the centre side of the ropes, that is, within them, the bucket when passing round the wheel, being very near the centre, is much retarded, and the momentum of the water causes it to ride out of the bucket very effectually into the trough. A peculiarity in the form of the bucket also prevents the spilling of the water in cases where the motion is very slow.

Sir J. Robison stated that, although the methods in India are rude, yet they give a greater return of work done for power applied than other methods known.—Mr. Jeffrey stated that he had tried this method on a large scale, each bucket containing 1½ cwt. of water. A small valve at the bottom of the bucket allows the air to enter, and the bucket is thus quickly emptied.

"*Additional Notice concerning the most economical and effective proportion of Engine Power to the tonnage of the hull in Steam Vessels, and more especially in those designed for long voyages.*" By Mr. Scott Russell

Large power or small power? has always been a disputed question. The early steam boat engines had but a small power proportioned to the tonnage. The *Comet* had 25 tons burden, and only three horses power—being a proportion of power to tonnage amounting to ⅛. On this subject modern practice and opinion seem to offer no guide. The East India Company have used low proportions of power to tonnage, and in this they appear to have adopted the general maxims of Southern engineers. The Government appear also to have followed the same course, but without going to the same extreme. The Clyde engineers adopt the opposite maxim, and place as much power in their vessels as can be conveniently applied. There appears at present to be a feeling in favour of a high proportion of power to tonnage. It has been found by some of the best mercantile companies that a high proportion of power to tonnage is not only better for expedition, but also more economical of fuel and of capital; and instances are frequent of an increase in the power of a steam vessel, producing a diminution in the consumption of fuel. As this question is becoming every day of greater importance, it is proper to examine it carefully. In the first place, it is known that the proportion of power must be very much increased to gain a given increase of speed;—thus, if ten horses power propel a vessel through water five mile an hours, it will require forty horses power to propel the same vessel ten miles an hour; since it will require a quadruple power to obtain a double speed, in like manner it will require a ninefold power to triple the speed. A large power of engine, it may be said, occupies much useful space which might be filled with cargo. It consumes much coal, and the speed is by no means proportioned to the expense of fuel and machinery. But this is a limited view of the subject. If time, as an element, and a very important one in the value of mercantile conveyance, be calculated, then it will be found that in many cases the effects of high speed, at any expense of fuel, will compensate for that expense. But it is not on the value of speed at the present day that we proceed in this inquiry. We are to ascertain what may be the best proportion of power to tonnage in sea-going vessels. We have seen that the lowest speed is the most economical, and that it requires expensive additions to give high velocities. But in arriving at this conclusion, we have taken only the case of smooth water: here it is obvious that the smallest power will be most economical. But it should be remembered that the great purposes of steam are generally of a different nature from the mere generation of motion through a quiescent fluid. The force of adverse winds, waves, and tides are to be overcome,—and it is the success of steam in obtaining regularity and speed, in spite of these, which constitutes its superiority. Now, if we take a simple case of one of these, we shall soon find that a higher proportion of power to tonnage may be essential not only to speed but even to economy. Suppose, a steam-boat with a small proportion of power, capable of propelling the vessel at the velocity of three miles an hour through still water, to be applied to stem a current of three miles an hour, or a proportionately strong breeze,—is it not plain that the vessel would make no headway? This extreme case of too little power shows that there is at least one proportion of power which is too small for economy of fuel. We may now proceed to investigate the question of best proportion, or the point where the attainment of high speed is accompanied by absolute saving of fuel, as compared to lower velocity. For this purpose we merely take it for granted, that the speed through the water will be nearly as the square root of the former, according to the general law of the resistance of fluids; that the resistance offered by adverse winds, &c. has been ascertained, and is determined on a particular station, that is, that it is known that on a given station, a given vessel, with a given power, makes a voyage in adverse circumstances in, suppose, double the time of her most prosperous voyage, say her prosperous voyage in fourteen, and her adverse voyage in twenty-four days, being a retarding power of ten days out of twenty-four; we take this retardation of ten days as the measure of the retarding power of adverse weather in the given circumstances. By working out the result, we obtain the very simple rule for finding the best proportion of power to tonnage: from the square of the velocity of any given vessel in good weather, subtract the square of the velocity of the same vessel in the worst weather, divide the difference by the square of the velocity in good weather, and the quotient multiplied into double the horses' power of the said vessel, will give the power which would propel the same vessel in the same circumstances, with the smallest quantity of fuel. It further appears, that the consumption of fuel in the worst voyage, will not exceed that of the best voyage, in a greater proportion than 10 to 7—that is to say, for 70 tons of fuel burnt on a good voyage, it will not be necessary to carry more than 100 tons, in order to provide against the worst. Let us take, as example, a Transatlantic steam-ship, which has a proportion of 1 horse power to 4 tons of capacity; her unfavourable voyage being, between England and America, twenty-two days, and her favourable voyage fourteen days, being a comparative velocity 7 and 11.

$$\text{Then } h' = 2\,h'\,\frac{v^2 - v'^2}{v^2} = 2.\ \frac{121 - 49}{121} = 2\ \frac{72}{121} = \frac{12}{10} \text{ nearly.}$$

Hence the power should be increased in the ratio of 6 to 5—that is to say, the engines at present capable of exerting a power of 500 horses should have been capable of exerting a power of 600 horses, and would, in this case, consume less fuel, as well as produce greater regularity. The following result also follows:—The vessel of less power burns 30 tons per day, performs the distance in fourteen days, consuming 420 tons of coal in fair weather. The vessel of less power burns 30 tons, performs the distance in twenty-two days, consuming 660 tons in foul weather. The vessel of greater power burns 36 tons, performs the distance in twelve and a half days, consuming 468 tons in fair weather. The vessel of greater power burns 36 tons, performs the distance in 17·5 days, consuming 630 tons in foul weather; being a consumption of 64 tons less fuel, and performing the journey in four and a half days less than the other. It is manifest, that the store of fuel carried in the vessel with less power, must, on all occasions, be equal to the greatest consumption, that is to say, at least 660 tons, whereas 630 tons will be sufficient for the vessel of greater power, and, as in all vessels for long voyages, coals carried are much more costly than the mere price of coals, or as the freight of the vessel is more costly than the fuel, coals carried are to be reckoned at least as expensive as coals burnt. Moreover, as the gain in time is 4½ out of 22, being 20 per cent., it is plain that the vessel may be calculated to do the distance oftener in a year, because, as the times of starting must be regulated not by the shorter, but by the longest period of a voyage, seventeen and a half days in the one case, stand in the place of twenty-two in the other. It appears, therefore, that, for long voyages especially, there are great advantages in point of economy, certainty, and speed to be obtained by the use of vessels of a higher power than usual; and that in a given case, the best proportion of power to tonnage may readily be determined from the rules already laid down. In regard to absolute or definite proportion, it may be stated, as the result of the best vessels, that the proportion of power to tonnage should not be greater than one horse power to two tons, nor less than one horse to three tons; the greater proportion holding in the smaller, and the less proportion of power in the greater vessel.

Mr. Fairbairn agreed, that the horse power should be increased, but that in bad weather the consumption of fuel was not so great as in fine weather.—Mr. Russell said, that practically in good weather the engines are worked expansively. There are two systems. The south engineers are afraid of using full powers; they use smaller proportions of power to tonnage, and slack the power in head winds. The north engineers always set head to wind in bad weather, and work full power; and in good weather work expansively. In steamers worked on the south system, the advantages would be as Mr. Fairbairn stated; in steamers worked on the north system, the advantages would be as he stated.—Mr. Fairbairn was of opinion, that three tons to one horse power were better than four to one.—Mr. Russell said, that it was safe to give more power than the rule gives; that on the introduction of longer and sharper vessels less power would be required.—Mr. Fairbairn observed, that the goverment post-office steamers, in the Mediterranean, were so bad, that the French vessels constantly pass them.

Mr. Smith made some observations "*On the Drainage of Railway Embankments and Slopes.*"—Mr. Vignoles observed, that had Mr. Smith had as much experience on railways and their construction as himself, he would have known that all he had recommended had been done on various occasions, whenever the expense could be justified.

Mr. Mallet "*On the Action of Air and Water on Iron.*"—Mr. Mallet stated, generally, the nature of the principal practical results obtained by him, with respect to the durability and modes of protecting cast iron, wrought iron, or steel, under various conditions, when exposed to the corroding or chemical action of air and water, whether fresh or salt. These researches have been made under the sanction of the Association, and are still in progress. Numerical results have already been obtained of the absolute and relative durabilities of about 100 different varieties or makes of cast iron and of wrought iron, in each of the following conditions as to water,—viz. In clear sea or ocean water; in foul sea water, as in the harbours of large cities; in clear river water; in foul river water; in sea water at high temperatures; in sea water at various depths; in sea water of variable saltness. The results in all these cases are given in voluminous tables, so arranged as to enable the engineer to predict with confidence the durability of a given scantling of iron of a given sort, under given circumstances. The conditions of corrosion of iron, in contact with copper, with zinc, and with tin, and with various atomic alloys of these, have been determined, and printed tables of the results distributed to the Section. Results are also given as to the relative protecting power of several paints or varnishes, to the surface of iron exposed as above. The specific gravities of all the irons experimented on, have been taken by a new method, and the increment of specific gravity due to increased depth (or head of metal) in castings determined, and also the decrement of specific gravity due to increased bulk or scantling of castings determined. These are necessary data to the foregoing investigation, and are in themselves of importance to the engineer, with reference to the ultimate cohesion of cast iron, which seems to be related, and probably is some function of the specific gravity in any given case. The experiments are now extended to wrought iron and steel; a final report is proposed, to consider the nature of the chemical changes induced on cast and wrought iron by the action of sea water, and to complete the numerical results now given, which have lately been in several instances submitted to control, or tested by the actual corrosion of castings recovered from the wrecks of the *Edgar* and *Royal George*, &c., and found strikingly to coincide.

Mr. Grimes described Dennett's Rockets for preserving lives from shipwreck, and read a letter from Capt. Denham, stating that the range of these rockets exceeded that of the mortar by 100 yards, the range of the rockets being about 350 yards, while that of the mortar was but about 250.

Dr. Wallace on Arches. The object of this paper was to exhibit a method for geometrically constructing a catenary. After explaining his method, Dr. Wallace stated that he was about to publish a set of tables for constructing the catenary, and also for suspension bridges.

Mr. Wallace exhibited and explained his smoke protector.—Mr. Hawkins exhibited and gave an account of Mr. J. R. Bakewell's instrument for measuring the angles of the dip of strata.—Mr. Rayner exhibited a machine for regulating the speed of machinery in cotton-mills, &c.—Mr. Smith, of Deanston, exhibited a model of a new canal lock, the advantages of which he stated to be, that the descent in each lock would not be more than twelve to eighteen inches—that the locks were opened by the passage of the vessels—that the locks shut of themselves—that the vessels did not require to stop—and that little or no water was lost. The lock gate is hinged at the bottom, the upper portion, which is round, floats at the level of the higher part of the water, and is pressed down by the bow of the vessel in passing, and when it has passed, rises to its former position.

"*Experimental Inquiry into the Strength of Iron, with respect to its application as a Substitute for Wood in Ship-building.*" By Mr. Fairbairn.

The number of vessels which of late years have been made entirely of iron, and the probability of the greatly extended use of this metal in ship-building, renders it desirable to attain additional knowledge as to its power to resist these strains to which it is subjected, in its application to the purposes above stated. Mr. Fairbairn's experiments have convinced him, that in proportion as the public become better acquainted with the valuable properties of this material, and its fitness for almost any purpose of naval architecture, they will be convinced that it is safer, and, perhaps, more durable than timber, and that confidence in it will be completely established. To meet the requirements for this purpose, the following series of experiments have been undertaken, and in a great measure completed. Part only, however, could at present be laid before the Section. 1st. A series of experiments on the strength of plates of iron, as regards a direct tensile strain, both in the direction of the fibre and across it. 2nd. On the strength of the joints in plates rivetted together, and on the best modes of riveting. 3rd. On the strength of the various forms of ribs or frames used in ship-building, whether wholly composed of iron, or of iron and wood. 4th. On the resistance of plates to compression and concussion, and on the power necessary to burst them. The experiments were superintended by Mr. Hodgkinson, to whom Mr. Fairbairn acknowledged himself indebted for many of the results.

On Strength of Iron Plates.—In these experiments all the plates were of uniform thickness. Their ends had plates rivetted to them on both sides, with holes bored through them perpendicular to the plate, in order that they might be connected by both, with shackles to tear them asunder in the middle, which was made narrower than the rest for that purpose. The results were as follow:—Mean breaking weight in tons per square inch, when drawn in the direction of the fibre.

		Tons.	
Yorkshire	plates	25·77	Mean 22·52 tons.
Do	do.	22·76	
Derbyshire	do.	21·68	
Shropshire	do.	22·83	
Staffordshire	do.	19·56	

Mean breaking weights in tons per square inch, when drawn across the fibre:—

Yorkshire	plates	27·49	Mean 23·04 tons.
Do.	do.	26·04	
Derbyshire	do.	18·65	
Shropshire	do.	22·00	
Staffordshire	do.	21·01	

The foregoing experiments show that there is little difference in the strength of iron plates, whether drawn in the direction of the fibre or across it. Mr. Fairbairn then gave the results of a long series of experiments on the strength of riveted plates. The same description of plates was here used, as in the previous experiments; the plates were however, made wider than the former, in order that they might contain (after the rivet-holes were punched out) the same area of cross section as the previous ones. Mean breaking weights in pounds, from four plates of equal section, rivetted by a single row of rivets:—

20127	Mean 18590 lb.
16107	
18982	
19147	

The mean breaking weights in pounds from four plates of equal sections to the last, but united with a double row of rivets:

22699	Mean 22258 lb.
23371	
20059	
22902	

Whence the strength of single to double riveting is as 18590 : 22258. But from a comparison of the results taken from the whole experiments, the strength derived from the double rivetted joints was to that of the single as 25030 : 18591, or as 1000 to 742. Comparing the strength of plates alone with that of double and single riveted joints, Mr. Fairbairn gave their relative values as under:—

For the strength of the plate	100
For that of double riveted joints	70
And for the single riveted joints	56

Hence the strength of plates to that of the joints, as the respective numbers, 100, 70, and 56. Mr. Fairbairn then gave a table containing the dimensions and distances of rivets for joining together different thicknesses of plates.

A discussion ensued as to the comparative strength and safety of iron boats. Mr. Fairbairn stated, that from the manner in which the sheathing is rivetted, the whole vessel becomes one mass; and though he did not come forward as the advocate of iron against wood, he would state that he considered iron as one-third stronger than wood, weight for weight.—Mr. Grantham knew iron boats that had lasted 28 years in fresh water.—Mr. Taylor built an iron boat for a canal in 1805, and it was now in good condition.—Mr. Mallett had found, from his experiments on the action of sea water upon iron, that the duration of a half-inch plate in sea water would be about 100 years.

Mr. Hodgkinson read a paper "*On the Strength of Pillars of Iron.*" This was an abstract of a paper by Mr. Hodgkinson, read at the Royal Society, of which we gave an abstract at the time.—(See Journal, No. 34, page 248.)

Mr. Fairbairn "*On raising Water from Low Lands.*" The commissioners for draining the Lake of Haarlem having applied to Mr. Fairbairn on the subject, he proposed a method where the water is raised by a large scoop, which rises on the descent of a weight, which weight is raised by steam power, on the Cornish principle. It is calculated to raise 17 tons at each stroke. Mr. Fairbairn exhibited a model in illustration.

Mr. Taylor mentioned, that he had that morning received a letter from Mr. Enys, stating that commissioners from the Dutch government had visited Cornwall, to ascertain the duty done by the Cornish engines. Several experiments had been made at their request, and the following was the result.

			Feet stroke.	Lifted one foot.
Wheal Vor, Borlase's engine..	80 in.	single	8·0	123,300,593lb.
Fowey Consols, Austin's	80	,,	9·0	122,731,766
Wheal Darlington Engine ..	80	,,	8·0	78,257,675
Charlestown United Mines ..	50	,,	7·5	55,912,392
Ditto Stamping engine......	32	lifting 66 stamps		60,525,000
Wheal Vor, ditto	36 dble.	lifting 72 stamps		50,085,000

Mr. Glynn stated, that by a scoop wheel 25 feet diameter, and 80 horse power, used by him in Lincolnshire, 4½ tons of water were raised in a second, the difference of level being about five feet.

Mr. Hawkins exhibited a Model of a Railway and Carriage, recently patented by Mr. Rangeley, and by him called *the Safety Rotation Railway;* which is an inversion of the ordinary construction, inasmuch as wheels are made to revolve on fixed bearings, placed in two parallel lines along the road; and the carriage, without wheels, is built upon a pair of running rails, carried along upon the peripheries of the train of wheels kept in revolution by steam-engines fixed at every mile or two of the road. It is intended to have the wheels three feet diameter, and three feet apart, which will give 1760 wheels on a mile. They are to be driven by a succession of endless bands, one band in every case passing around two pullies attached to every two contiguous wheels. The carriages are designed to hold forty passengers each, with their luggage; the whole, including the carriage, not to exceed five tons: the running rails always to bear on eight or ten wheels, so that no wheel shall have to support more than about ten or twelve hundred weight. The wheels, therefore, need not weigh more than half a hundred weight each, to be sufficiently strong for supporting the carriage. It is found by experiment, that three ounces suspended from the periphery of such a wheel, causes it to revolve. Any weight that sets a wheel in motion, will, if continued, cause the same to revolve with accelerated velocity, until the resistance of the atmosphere becomes equal to the accumulated force, after which, a steady speed will be kept up. It is inferred from observation, that the wheels driven with a continued force of three ounces each, would acquire a constant speed of about thirty miles an hour. It is also ascertained from experiment, that eight pounds would draw a ton weight on four three-feet wheels running on level rails, and thus that a force of forty pounds would draw the carriage. The following table is constructed from data, by which it is found that seventeen horse power of steam-engine is required to turn each mile of wheels, and two horse power to drive each carriage. The power to turn the wheels, is neither increased by additional carriages nor by acclivities; each carriage added, taking only two horse power more to carry it along upon a level; and an acclivity of 1 in 180 doubling, 1 in 90 quadrupling, and 1 in 45 octupling only the tractive force, without in any case requiring more than the seventeen horse power to turn the wheels.

Carriages Every 2 Minutes.	PASSENGERS.		HORSE POWER. Per Mile in 2 Minutes.			
	Every 2 Minutes	In 12 Hours.	On a Level.	Up 1 in 180.	Up 1 in 90.	Up 1 in 45.
1	40	14,400	19	21	25	33
2	80	28,800	21	25	33	49
3	120	43,200	23	29	41	65
4	160	57,600	25	33	49	81
5	200	72,000	27	37	57	97

The Britannia.—This steamer has brought to Havre from London an ir steamer in 372 pieces. The vessel, which is destined for the Lake of G will be 135 feet long, and these materials are to be transported thither f with.

REVIEWS.

Penny Cyclopædia. Part 92. Article "Portico."

Unless the style adopted prohibits the introduction of such feature, a portico is now considered almost a *sine qua non* in a design; ample proof of which being the case was afforded by those for the Royal Exchange, the Assize Courts at Liverpool, &c.; and yet, whether in designs or executed buildings, we very rarely find any attempt at originality, or any fresh combinations in regard to plan. On the contrary, nearly all our porticoes consist merely of a single range of columns in front, and it is fortunate when that disposition of them is attended with the negative merit of there being no disagreeable drawback on the effect aimed at by them, resulting from a mean background to the external elevation. In fact, notwithstanding that so very much depends upon them, and almost endless variety may be obtained from them, *plan* and *background*—*i.e.* the interior elevation of the portico—have scarcely any study or attention at all bestowed upon them. We trust, however, that the very excellent article which has just appeared in the Penny Cyclopædia—a work which has already more than once obtained our notice and approbation for the architectural information it contains—will not be thrown away upon the profession, but spirit them up to endeavour to get out of their old routine course, and give us something more than six or eight columns, put beneath a pediment.

When we inform our readers that the article in the Cyclopædia extends to several pages, we hardly need observe that it is altogether original, for we know of no other work of the kind which contains much more than a mere definition of the term itself, while here in addition to the information brought together, there is a very great deal of able comment and criticism. Even were there nothing else to recommend it, this article would deserve to be noticed by us on account of the novel and ingenious terms invented by the writer to express clearly at once, of what kind a portico is, as regards its flanks, and its projection from the building to which it is attached. For this purpose he makes use of the terms *Monoprostyle*, *Diprostyle*, *Hyper-diprostyle*, *Triprostyle*, &c., the first indicating the simplest form of prostyle, namely, that which projects only one intercolumn before the building; the second, that which projects two intercolumns, and so on. By this most convenient innovation in architectural terminology,—and therefore likely to be generally adopted at once,—the plan of the portico of St. Martin's Church, would be clearly described by terming it Hexastyle Diprostyle, that is, having six columns, or five intercolumns in front and two intercolumns at its flanks, consequently one column there besides that at the angle. A *Triprostyle* has of course three open intercolumns at its sides; but the meaning of *Hyper-diprostyle* requires some explanation,—after which it becomes obvious enough, this term being coined by the writer to express that besides having two open intercolumns, the portico is advanced from the building by an additional space, whether equal to a third intercolumn or not: thus the portico of the National Gallery is described as a Corinthian Octastyle, *Hyper-diprostyle*, and with regard to its interior as having a distyle in antis within it,—that is, a recess of three intercolumns, produced by two columns between antæ.

The article is illustrated with a great many plans, showing various arrangements, and is further accompanied with a table of some of the more remarkable examples, which we shall here give, referring our readers to the Cyclopædia itself for the rest of the article, not doubting that they will procure the number which contains it.

TABLE OF PORTICOES.

Class.	Order.	Building.	Architect.	Remarks.
Dodecastyle	Corinth.	Chamber of Deputies, Paris	Poyet	Monoprostyle, sculptured pediment.
Decastyle	..	University College, London	Wilkins	Hyper-diprostyle, recessed. Height of columns 30 feet.
Octastyle	..	Pantheon, Rome	......	Hyper-triprostyle. Polystyle and recessed.
..	..	National Gallery, London	Wilkins	Hyper-diprostyle, with distyle in antis, recess within.
..	..	Fitzwilliam Museum, Cambridge	Basevi	Monoprostyle, recessed, and with order continued laterally, forming three intercolumns on each side.
..	..	Victoria Rooms, Bristol	Dyer	Unequal diprostyle, recessed, five intercolumns.
..	..	Exchange, Glasgow	Hamilton	Diprostyle, with two inner columns corresponding with second and seventh of the octastyle.
..	..	Buckingham Palace	Nash	Columns fluted, their height 26 feet
Octastyle-Peripteral	..	Birmingham Town-hall	Hansom and Welsh	Columns 36 feet high. Side elevations of twelve intercolumns on flanks.
..	..	La Madeleine, Paris	Huvé	See Paris.
..	..	Girard College, Philadelphia	Walter	Columns 55 feet high; marble.
..	Doric	The Walhalla, Bavaria	Klenze	
Octastyle	Ionic	Glyptotheca, Munich	Klenze	Monoprostyle, polystyle, recessed, tetrastyle in antis.
..	..	Great Theatre, Petersburg	Thomond	Monoprostyle.
..	Doric	Church at Possagno	Canova	Diprostyle, polystyle, double octastyle.
..	..	Manège, Petersburg	Quarenghi	Monoprostyle, polystyle, recessed.
..	..	Royal Institution, Edinburgh		
Hexastyle	Corinth.	St. Martin's, Charing-cross	Gibbs	Diprostyle, height of columns 34 feet.
..	..	St. George's, Bloomsbury	Hawksmore	Diprostyle, five arched doors, and five arched windows above them.
..	..	St. George's, Hanover Sq.	J. James	Monoprostyle.
..	..	Law Courts, Dublin	Cooley and Gandon	Monoprostyle.
..	..	Kazan Church, Petersburg	Voronikhin	Diprostyle, polystyle, a triple hexastyle.
..	..	Pantheon, Paris	Soufflot	Reliefs within portico, height of columns 62 feet.
..	..	Madre di Iddio, Turin	Buonsignore	A diprostyle, attached to a rotunda. Two inner columns behind the penultimate ones in front.
..	..	Custom-house, New York	W. Ross	Monoprostyle. White marble; columns 32 feet high.
..	..	St. Nicholas's Potsdam	Schinkel	Hyper-monoprostyle.
..	Ionic	Bethlem Hospital, London	Lewis	Monoprostyle; height of columns 36 feet.
..	..	Post-office, London	Smirke	Diprostyle, recessed, columns 37 feet high.
..	..	Theatre, Berlin	Schinkel	Monoprostyle, flight of steps in front.
..	..	East India House, London	Jupp	Pseudo-prostyle; height of columns 30 feet.
..	..	St. Pancras' Church, London	Messrs. Inwood	Monoprostyle; florid Ionic; columns 36 feet high.
..	..	Royal Institution, Manchester	C. Barry	Monoprostyle. Order continued laterally, forming loggias of three intercolumns on each side of prostyle.
..	..	Post-Office, Dublin	F. Johnston	Monoprostyle, columns 36 feet high, fluted.
..	..	Raadhus, Copenhagen	Hansen	Monoprostyle; deep recess in centre with steps.
..	Doric	Colosseum, London	D. Burton	A monoprostyle attached to a polygon.
..	..	Hunterian Museum, Glasgow	......	Monoprostyle, recessed, with a distyle in antis.
..	..	County Hall, Chester	T. Harrison	Monoprostyle, polystyle, recessed. A double hexastyle.
..	..	Wacht-Gebaude, Berlin	Schinkel	Monoprostyle, recessed as a tetrastyle in antis.
Pseudo-hexastyle	Corinth.	Front of Roman Catholic Chapel, Finsbury Circus	......	Four pilasters and two columns beneath a pediment, or five intercolumns.

Papers on Iron and Steel, Practical and Experimental. By David Mushet. London: Weale, 1840.

Second Notice.

Iron possesses among metallic products the same pre-eminence which cotton has over those of vegetable origin, and has for many centuries been one of the great staples of our foreign trade, and a main supporter of our internal industry; to the progress of this manufacture in our own country we shall subsequently have occasion to refer, we shall now therefore call attention to its origin elsewhere. Mr. Mushet in his fourteenth paper combats the traditional account of the discovery of iron in Greece by the accidental burning of a forest, and gives a probable theory so well confirmed by experience here as to carry with it a high degree of authority. I have seen, says he, a mass of perfectly malleable iron produced by roasting a species of ironstone, united with a considerable quantity of bituminons matter. After a high temperature had been excited in the interior of the pile plates of malleable iron of a tough and flexible nature were found, and under circumstances where there was no fuel but that furnished by the ore itself. Mr. Mushet thence argues the possibility of the properties of the metal having been discovered during the process of making charcoal by a mass of ore accidentally dropping into the burning pile. Iron, it is most probable, was for a long time after its discovery applied solely to agricultural purposes, for the want of a regular method of converting it into steel long gave a preference to hardened copper and its alloys as the material for edged tools and instruments of war. So little indeed was the art of making steel advanced, that a present of 40 lbs. of steel from Porus to Alexander is quoted by biographers as a most acceptable and valuable gift.* Even in India itself where this branch of art is now carried on upon a very extensive scale, the progress seems to have been very slow, for the value of that gift of Porus would now be the produce of one man's labour in 240 days. It is to India however, that according to the best authorities we are to look for the origin of steel, and from which other countries were supplied; even the obelisks of Egypt being supposed to have been worked with Indian tools. Among ourselves the production of iron claims a very early date, for there is every probability of the Cornish mines having been worked at least 2300 years ago by the Phenicians, while we know by the testimony of Cæsar† that this branch of mining was still pursued by the nations inhabiting Britain. The current money was of brass or iron, valued according to weight, although Cæsar observes that the produce of this latter metal, which was worked in the maritime districts was small. As however the tin trade had long been a staple, and copper and brass were imported, it may be reasonably doubted whether among a mining population, the workings were, although rude, carried on upon a greater scale of magnitude than is implied from the terms used by the Romans. During the subsequent occupation by the Romans, remains now existing fully attest that the workings were kept up by them, and indeed during the whole period of history there seems to have been no intermission in the prosecution of this branch of the national wealth and strength. The Danes are particularly noted in this pursuit, and large heaps of scoria, named after them, are to this day to be met with in many parts of England, with so great an accumulation of soil upon them as to bear trees of large size. At the time of the Norman accession we find the king demanding of the inhabitants of Gloster 36 icres of iron, for making nails for his fleet, every icre to consist of 10 bars or rods of iron; which iron was very probably made in the neighbourhood in the Forest of Dean. The kings of England held in this forest iron works, consisting of three blast furnaces and two forges, which are supposed to have been given up by Charles 1st, somewhere about the year 1637. Cromwell and other princes are also said to have embarked capital in such pursuits, and indeed the iron trade seems always to have been the object of the highest solicitude.

One of the first events which led to an extension of the iron trade, particularly as regards castings, was the invention of cannon, the precise date of which is not however known. Cast iron is said by M. Verlit to have been known in Holland in the 13th century, and staves to have been cast from it at Elass in 1400, but how produced is not known. Cannon are mentioned in a record of the accounts of the Chamber of Paris in 1338, and were used by the English at Cressy in 1346, and by the Venetians in 1366 and 7, but we are by no means to conclude that such cannon were cast, as for two hundred years hooped cannon were made, formed of staves of wrought iron, bound together with strong hoops of the same metal. It was not until 1547 that the first iron guns were cast in London by a person named Owen. The precise date of the origin of the blast furnace is far from being ascertained. Mr. Mushet who has investigated the subject with his usual research, seems to be of opinion that it cannot be beyond the beginning of the seventeenth century. It is then that we perceive a fresh epoch in the progress of the manufacture, as a greater power of blast was required, the old situations would be abandoned, and the iron trade pass from the township in the neighbourhood of the mines to the banks of the adjacent streams; this is particularly evident from examining the sites of the oldest workings. The introduction, or invention of the blast furnace here, for we seem to have some claim to its first use, was productive of a great extension of the trade; a great exportation of iron artillery to the continent was the result, and without giving implicit belief to the statements of Dudley, in his Metallum Martis, we are still bound to believe that the trade was great. According to Dudley's computation in 1615, there were then no less than 300 blast furnaces for smelting iron ore with charcoal, and 500 forges and iron mills. The total quantity of iron produced from the works is said to have been 180,000 tons per year, an enormous amount considered in relation to the then population of the country, although not impossible so far as the question of fuel is concerned. Supposing Dudley's statement of the number of furnaces to be accurate, although some question may be raised upon that point, a deduction is still to be made for furnaces out of blast and building, for which, from modern experience we might easily assume the deduction of a third, leaving 200 as the actual number in work. A less number of weeks (perhaps 35), and a lower average (say 12), should also be taken, and the estimated produce would then not exceed 80,000 tons, a quantity by no means incredible. It may be mentioned here by the way that the extensive exportation of artillery is not only in favour of the origin of blast furnaces in this country, but also of our possessing a very large share of this trade, which might well give an impulse to it in this country.

We have now to contemplate the history of another great improvement, the use of pit coal, for which we find several patents granted by James I. In 1612 a patent was granted to Simeon Sturtevant, Esq. (seemingly a Dutch name) for 31 years for making iron with pitcoal, in return for which patent Sturtevant was bound to publish his discoveries, which appeared in a quarto form under the name of "Metallica." In the next year Sturtevant, having tried his plan upon a large scale and failed, was obliged to give up his monopoly. John Ravenson, Esq., was the next in the field, and was also enjoined by his patent to publish his discoveries, which he did under the title of his "Metallica." Several other candidates also failed, when, in 1619, a new competitor came into the field, who was destined to excite more attention. Dudley's father possessed iron works at Pinsent, in Worcestershire, and it was there that Dudley perfected the patent which he obtained in 1619. He declared that although he made only at the rate of three tons of pig iron weekly, that he made it with profit. His success was such as to excite the alarm of the charcoal iron manufacturers, who formed a powerful opposition, and obtained a limitation of his patent from 31 to 14 years, new adventurers also sprang up to encroach upon his rights, until at last their rivalship, and his attachment to the cause of Charles 1st, prevented his improvements from being followed up. In the meanwhile the deficiency of wood had begun to be felt, and Dudley had fully proved the efficacy of his plan for the manufacture of pig and bar iron, and for various castings, all of which he sold much lower than the charcoal-manufacturers. In the article of castings alone, Mr. Mushet says, he must have had greatly the start of the charcoal foundries, as the quality of carbonated coke pig iron is far superior to that of the charcoal iron of this country for the general purposes of casting. Such success greatly provoked the hostility of his rivals, particularly of those who still possessed a good supply of fuel, who at last in the true spirit of combination led on an attack upon his devoted works, and led to the evil results to which we have alluded. His improved bellows, forge, &c. all fell a prey to the lawless banditti. While he was thus openly plundered, his rivals were not less active in endeavouring to undermine him, or at least profit by his success by evasions of his patent. Among these attempts that of Captain Buck, Major Wildman and others is a singular instance of failure. Attacked on all sides Dudley was also foiled in 1663, in his last attempt to obtain a patent from Charles the Second, and deserted by all,he was compelled to give up the pursuit.—Dudley was the author among other works of the "Metallum Martis," in which we possess many curious details of the early state of the trade. We may here pause and view the present state of the charcoal iron manufacture, which from 310 furnaces has dwindled down to insiguificance, so as to be almost extinct, the whole annual quantity manufactured not exceeding 1000 tons. In Lancashire, two or three furnaces are occasionally in blast, and one in Argyleshire. The purposes to which iron made from this fuel is now applied are limited indeed. In Lancashire a small quantity of steel iron for the Sheffield market has of late years been made from it; but the principal consumption is for casting knives, forks, razors, snuffers, bridle bits, stirrup irons, &c. These articles, after having been cast, undergo a process of deoxidation, which gives them a surprising degree of tenacity, with great flexibility and a capacity of polish resembling steel; those castings, not intended to receive a polish, present surfaces capable of receiving and retaining tin for a considerable length of time.

---

* Quintus Curtius, B. 9, ch. 25. Ferri candidi talenta centum.

† De Bello Gallico, L. 5, c. 10.

To return to the date where we left off, we may observe that the improvements which had been made had increased the power of the furnaces, from which as well probably as from their concentration a diminution had taken place in their number. In a prospectus drawn up about the year 1720, near the time of the South Sea Bubble, we find the number of furnaces rated at only 59, but as this list is manifestly imperfect, we are perhaps bound to consider the number as larger. Sussex, Kent, and Hampshire were then the seat of 15 furnaces, now of not one. Resuming the history of pitcoal iron we find that after the time of Dudley, nothing of importance was done until 1740, when a new auxiliary, the steam engine, had come into the field. The application of this machine gave the manufacturer greater liberty in selecting the site of his works, and enabled him to erect larger furnaces with a proportionate quantity of blast. From this date the use of pitcoal every year became more prevalent, and has ended by superseding charcoal in this country. In aid of this two other circumstances operated with advantage, the introduction of Mr. Watt's double blast engine, and the invention of puddling and rolling bar iron by Mr. Cort.

In our own days improvements not less important have been effected, and since the commencement of the literary career of the author, whose work is now before us, the quantity of pig iron necessary to produce a ton of bar iron has been reduced from 40 cwt. to 26 or 27 cwt., with almost as great an economy of fuel. This has principally been accomplished by means of the hot blast, the use of which however can be only considered as recently established, so strong was the prejudice against its application. One great property it possesses is that it diminishes the quantity of vitreous matter formerly required in the furnaces, so as to diminish the consumption of both fuel and limestone. An equalization of the blast is another result, so as to diminish the effect of the atmospheric influence, which it is well known interferes with the operations of the furnace. In this, as in other countries, a larger produce of cast iron is obtained in the winter months than during the summer or autumn, while the quality of the metal is improved by being much more carbonated and less fuel is consumed. During the months of June, July and August, more especially in hot seasons, the quality of the iron in this country will be depreciated 30 per cent., and the quantity very considerably reduced, and in many parts of Sweden, says Mr. Mushet, when the summer heats are intense, the manufacturer is obliged to blow out or stop his furnace for two or three months; not only is he unable to make carbonated metal, but is frequently incapable of keeping the furnace in such trim as to make a produce of any quality whatever.

An improvement scarcely inferior in importance, although only local was the discovery by the author in 1801, of the Mushetstone or Black Band ironstone, a new class of carboniferous ironstone, principally found near the river Calder, near Glasgow, but also in South Staffordshire, North Wales, and North Staffordshire, in which latter district it is called Red Mine. Although used by Mr. Mushet in the Calder iron works, so strong was the prejudice against it that it was not until 1825 that its application was at all extensive. It is now used in about 50 furnaces in Scotland, and the quantity of iron produced is above 100,000 tons; on one estate alone £12,000 is received as royalty in consequence of this discovery. A powerful auxiliary in the hands of the Scotch masters has been the use of raw pit coal, and coking under dust, which have been found to be particularly suited to the Scotch coal and iron. A dawning discovery and one which promises to be not less important than that of the Mushetstone, is Mr. Crane's process for smelting iron with anthracite, thus making available a large supply of mineral wealth, and extending our national resources.

A Practical Inquiry into the Laws of Excavation and Embankment upon Railways, being an attempt to develop the natural causes which affect the progress of such works, &c. By a a Resident Assistant Engineer. London: Saunders and Otley, 1840.

It may be laid down as a general axiom that in every inquiry of this nature, the degree of dependance which shall be placed upon the laws established, should be proportionate to the extent and generality of the experiments on which such laws are founded.

If we take as our groundwork the gross performances of a long series of months during which the attendant circumstances as to weather, state of the earth, as it may be wet or dry, adhesive, loose, or crumbling, and so troublesome or otherwise in filling and teaming, with all the other circumstances by which earth-works are affected, we shall be able to deduce from these in connection with detailed experiments upon the requisite particulars of getting, filling, teaming, and times of travelling, a tolerably perfect set of expressions by which calculations may be made with reference to earth works in general.

It must be borne in mind, however, that all results derived from such expressions, however accurately determined, and however comprehensive the data from which they have been derived, are still liable to be affected by circumstances which no human foresight can predict. All that can ever be with safety relied upon is, that supposing all attendant circumstances to be identical as to effects with those which had place during the period of former observations, then that the calculations applied to other works varying in form and magnitude, shall give results agreeing with such former observations.

But if we attempt without reference to the gross-performance during some long period, to derive from the observation of a few days, fixed laws for the actual time of executing large works, it is obvious how impossible it must be to derive correct results in any such way. The days during which the observations have been made, may have been remarkably fine or remarkably unfavourable, or in some intermediate stage between these. But whatever this stage may have been, there is no alternative but to adopt them as our standard for the whole year, and thus it will be seen on what an unstable foundation such a structure must be raised.

We do not mean to say that any experimentalist would so far stultify himself as to proceed blindly on the isolated experiments of certain days on which the performances would notoriously be either much less or much more than on the average of the year, but we can readily imagine that the imputation of improper selection can scarcely fail to apply more or less to the experiments of any 10 or 12 single days at any period of the year. Let us suppose on the one hand one of the dull gloomy days of our winter months, the ground slowly parting with the frost which had hardened it for some weeks before—the falls of earth possessing more than usual tenacity, the workmens' tools clogged with the soft retentive clay adhering to every thing like bird lime; the rails clammy and dirty from the same cause, the wagons when teamed retaining a third of their contents plastered to the sides and bottom, and so requiring double the time for teaming, and then let us with this contrast a fine dry day of spring or autumn, the rails almost free from dirt, the shovels all clean and bright, and parting instantly with the contents filled into the wagons. These latter again when tipped immediately discharging their contents, and leaving none to be shovelled out by the teamers. And let us ask any man, practical or not practical, on which day the performance will be greatest. We shall not hesitate to say that the performance on the one day shall be 50 per cent. more than on the other, and shall be independent of the number of hands employed, because assuming that on the favourable day each department of the labour is occupied by the proper proportion of men and horses, then on the unfavourable day an increased number will rather serve to impede than to hasten, as they will be in each others way, and the hands will at intervals have to wait for their turn to exert themselves, it being impossible that more than a certain number at a time can be fully employed.

We repeat we have no intention of charging the experiments before us, or any other of the same kind with such glaring absurdity as would attach to them, did they exhibit the extraordinary results of one or other of the extremes we have pointed out as a foundation for estimating the work of the year, but we contend the chances are, that as isolated experiments they bear more or less to one or other of the extremes. It is barely possible that the days selected shall represent a fair average of what may be done throughout the year.

It is for such reasons that we would hesitate before adopting as the basis of important calculations, the results of a few days observation.

We would much rather rely on well authenticated records of the performance during many months, under different systems of working, and we would suggest to the author of the present treatise, and to all others who may in future undertake experimental inquiries of this nature, that the really practical and experienced, whether engineers or contractors, will invariably. as their test upon the accuracy of any particular theory, however derived, proceed at once to compare the results which such a theory will give them with their own actual knowledge of what has been done on the great scale in other works. They will therefore pronounce the theory correct or otherwise, according as it coincides or disagrees with their own experience. We are thus over and over again impressed with the importance of founding all theories upon the actual performance of as long a period as possible.

Let it not be understood that we are here objecting to experiments in detail. These are exceedingly useful, because placing as they do before our eyes the precise amount of time occupied in all the various tages through which the soil passes from its original position in the cutting till it is finally placed in the embankment, we are better able justly to apportion the quantity of labour necessary in each several department, and so to economize both time and money.

Our author professes to have selected the experiments he has given from a much more extensive series, and this may possibly be held as an answer to our objections, as to the limited space over which the experiments extend, but it must be understood we are not objecting to the insufficiency of these experiments, for the purpose of showing the distinct periods of time occupied in the several processes of filling, tipping, and travelling; the real meagreness of the experiments, we conceive, arises from the absence of all information as to the gross performance of some long periods. It is obvious that with such information, even should the results not agree with those which might be derived from calculation by the author's formulæ, these latter might still be of service, as expressing the ratio of the times occupied by the various details of earthwork operations, and this, we apprehend, is almost the extent of what can be expected from the experiments we are considering.

Thus should we find that the calculations on being applied to any particular work already executed, shall afford a less result in point of performance than we actually know to have been accomplished, we may still perhaps rely upon the numercial relation to each other of the several times determined in the experiments, which form the basis of such calculations. We may conclude that the separate times assumed for filling, teaming and travelling are all too great, but that they may all safely be reduced in a certain ratio: and when so reduced we may be satisfied with the conclusions they establish. Thus for purposes of comparison as to the amounts of labour which can most advantageously be employed in the several departments of earthworks, we hold the experiments in this book to be extremely useful, and we think with the restriction we have laid down against applying them to establish gross results, that they may be safely depended upon.

We will now briefly describe the mode of investigation pursued in this work.

From the observations of sixteen days the author proceeds to establish first the rate of speed at which the wagons travel, and then the time occupied in tipping each wagon, or each set of wagons, supposing a sufficient number of men at the teaming place to prevent unnecessary delay. His method of deriving the rate of speed is neat and ingenious, and liable to less objection than actual observation on the time of passing between fixed points. For instance, the time occupied in "filling, removing, and tipping the wagons," as the average of several experiments, on a lead of half a mile, was 55 minutes. Also the time occupied in filling, removing, and tipping the wagons on a lead of three-quarters of a mile, amounted to 69·47 minutes. Hence we have $69{\cdot}47 - 55 = 14{\cdot}47$ minutes for the difference between the time required for filling, removing, tipping and bringing back a set of wagons upon a lead of three-quarters of a mile long; and the time required for filling, removing, tipping and bringing back a set of wagons upon a lead of half a mile long. This difference, namely, 14·47 minutes is evidently the time which elapsed while the horses were drawing the loaded and empty wagons backwards and forwards over a quarter of a mile, or in fact the difference in the lengths of the leads.

"This shows that the average speed of transit rates at 2·40 miles per hour."

We regret to be under the necessity of pointing out that the author has here made an error in calculation, as may at once be verified by ascertaining the rate of speed corresponding to half a mile in 14·47 minutes. This rate will be found equal to 2·07, instead of 2·40 miles per hour; a material difference, and one which must affect any subsequent calculations founded upon it. We believe that the rate made use of by the author, namely, 2·40, is more correct in practice than the other, but this tends rather to weaken our faith in the experiments, since they undoubtedly, by the author's own showing, establish 2·07 miles per hour as the rate of horses' speed in transporting earth. To proceed, the time of tipping is then found $= 7{\cdot}06$ minutes, and that of filling $= 19$ minutes, both these being derived, independently of the rate of speed, and so not affected by the error we have pointed out above.

From the data thus established, our author derives in a simple manner, the necessary expressions for finding the number of wagon loads which may be removed from cutting to embankment in a given time, with a given number of wagons, both for constant and varying loads.

The next section is devoted to the investigation of the causes which limit the rate of progress in forming an embankment. The author shows that this rate of progress is limited by the number of teaming, or as he terms them shunt roads, which can be fixed at the end of the embankment, and this number will of course depend upon the height, top breadth, and rate of slopes of the embankment, as affording a greater or less breadth to team over. The breadth occupied by each road, he assumes at 8 feet, so that the whole breadth available for teaming over being divided by 8, will give the number of roads which can be laid down.

It will now be necessary to notice the author's hypothesis as to the available breadth of the teaming or battery head. He assumes that most soils will stand at a slope of 1½ to 1, when first tipped, and as most embankments are to be finally dressed off to flatter slopes than this, the difference between the base for a slope of 1½ to 1, and that for the slope to which the embankment is to be finally dressed off will be so much additional breadth, which being added to the top breadth will give the whole available breadth for teaming. Thus for an embankment 40 feet high, slopes 2 to 1, and top breadth 30 feet, we shall have $\overline{40\times2\times2+30}-\overline{40\times1\tfrac{1}{2}\times2}=190-120=70$ feet, the available breadth for teaming over in this case.

This brief analysis contains, we believe, the elements of the author's theory, as to the limits of progress in an embankment, for taking 7·07 minutes as the time of tipping a set of wagons, it is evident that 84·8 can be tipped from each shunt road in a day of 10 hours.

The number of wagons that can be tipped per day from each shunt road, being multiplied by the number of these roads, gives the total number of wagon loads that can be tipped per day from all the roads, and this number being multiplied again by 250, the working days in a year, gives the whole performance in wagon loads per annum.

The quantity in cube yards depends of course on the capacity of the wagons, which varies from two to three cube yards, according as they are heaped or not, and according to their build.

Our opinion of this part of the author's work is principally influenced by comparing the gross results which his calculations establish as to the rate of progress, with what we know to have been the actual performance in cases where every effort was made to get through as large a quantity of work as possible. Taking the case of an embankment 50 feet high, slopes 2 to 1, and top breadth 30 feet, it would appear by the formulæ that we have been considering, that 848 wagon loads, or say (at the most moderate allowance for each wagon) 1696 cube yards per day of 10 hours, can be tipped at each end of the embankment. We think our author would be somewhet puzzled to point out an instance where even two-thirds of this amount has ever been performed, under the circumstances we have supposed, even for a single day, much less during any long continued period.

There is some difficulty in comparing the formulæ in detail with actual performance, for the want of knowing the breadth of tip in the latter cases. There is however one well authenticated example which may be found in the evidence of Mr. Provis, on the London and Brighton Railways.

We allude to his description of the great Skelmere embankment on the Birmingham and Liverpool Canal, where he states, that over a breadth of 60 feet, 105,000 yards were teamed in 16 weeks during fine summer weather, being at the rate of 1094 cube yards per day.

"During one month," however, says Mr. Provis, "we worked double gangs, beginning at three in the morning, and ending at ten at night." So that this quantity reduced to days of ten hours in length, becomes 105,000 in 120 days, equal to 875 yards per day. It must be remembered that Mr. Provis was here certainly not *understating* the performance on this work. It was his interest to show the greatest possible quantity which had ever before been accomplished, and the fact he relates was considered at the time, as indeed it is entitled to be considered now, a wonderful and almost unexampled performance, exhibiting no small share of contrivance and energy on the part of those directing the operations.

We shall only further remark that up to April 1837, no instance could be found where even 200,000 yards had been teamed into embankment from one face in a year; whereas our author's formulæ for an embankment of the dimensions last described, would lead us to calculate taking 250 working days in a year, as a performance of 424,000 yards per annum, and this too without nightwork, but simply during 250 days of 10 hours each.

The difference between actual experience and the results of our author's experiments arises here, we conceive, principally from the use of the constant 7·07 minutes as the time of tipping. This time may be perfectly correct as applicable to small embankments, and a few sets of wagons where there is no danger that either men, horses, or wagons will ever be in each others way, but we conceive it is quite inapplicable to large works, where interruptions to the regularity of proceeding would inevitably be very frequent, if the wagons were worked with the proper complement of labour to ensure the condition that no instant of time shall be lost at the teaming place. Thus it will ever be found that the theory here laid down furnishes results as to gross performance, which must not be expected in practice.

The second part of the work commence with an inquiry into the effects of the lead, principally as determining the number of wagons to be employed for different lengths of lead. Without accompanying the author through his investigation of this subject, it may be sufficient to say that while his theoretical deductions from certain assumed data cannot be objected to, yet these deductions are certainly at variance with what any practical man would think of adopting. For instance, he ascestains by means of this investigation, that for working a 20 feet embankment at one end only, and for a lead of 150 chains, there should be employed no fewer than 109 horses and 235 wagons, a proposal sufficiently monstrous to startle any one at all acquainted with the nature of earthworks.

The next section is devoted to an examination "of the amount of friction incident upon contractor's rails." The author here establishes that the gross load for a horse on contractors' rails may vary (on a level?) from 5·28 to 7·17 tons, so that knowing the weight of the wagons employed, and deducting this from the gross load mentioned above, we may readily ascertain the number of wagons to be assigned to each horse, provided the quantity of stuff which each wagon is to hold be known, or *vice versa*, the quantity of stuff which each wagon is to carry, according as 1, 2, or 3 wagons are to be drawn by each horse.

The following extract from this section exhibits the author's results derived from an examination of the friction.

"Let P represent the power of a horse, F the friction per ton, upon the load which he draws, and W the weight of a loaded wagon in tons; then it follows, that

$$\frac{P}{F \times W} = X$$

is the load proper for each horse, expressed in wagons; and this value of X has been given in the following table:—

TABLE, GIVING THE LOAD PROPER FOR A SINGE HORSE, EXPRESSED IN WAGONS, ACCORDING TO THE STATE OF THE WEATHER.

Value of F in lb.	Value of W in tons.	Value of P in lb.	Valne of $\frac{P}{F \times W}$	Value of X.	State of the weather.	Remarks.
25·45	3·43	188·27	$\frac{188{\cdot}27}{25{\cdot}45 \times 3{\cdot}43}$	2·09	Fine.	Rails in good order.
31·22	3·43	188·27	$\frac{188{\cdot}27}{31{\cdot}22 \times 3{\cdot}43}$	1·75	Fine.	Road wet, and rails greasy.
26·86	3·43	188·27	$\frac{188{\cdot}27}{26{\cdot}06 \times 3{\cdot}43}$	2·04	Fine.	Rails and road in tolerable order.
35·54	3·43	188·27	$\frac{188{\cdot}27}{35{\cdot}54 \times 3{\cdot}43}$	1·54	Wet.	Road and rails in very bad order.

We observe that in several pages of this section the erroneous velocity of 2·40 miles per hour is made use of.

The eighth section contains a summary of those preceding, but as we have already considered these so minutely, it may be unnecessary to remark particularly on the summary.

The remainder of the work is occupied by an investigation into the barrowing system, our notice of which we must defer till next month, and in the mean time we may safely recommend the work to the younger branches of the profession, as exhibiting a very neat, clear, and simple application of algebraical calculation to subjects of practical inquiry.

For the reasons already so fully stated, we cannot advise dependance on the gross results to be derived from the author's mode of calculation, but whenever the student shall either from his own, or the experience of others, have acquired sufficient *data* to found his calculations upon, then the method of handling the subject generally, and particularly of adapting calculations to the practical facts on which they are established, will be found exceedingly useful.

A great deal of useful information may also be gleaned from the observations detailed in the work, and the young engineer in particular, can scarcely fail to have his knowledge of the subject improved by a perusal.

Report of a Proposed Line of Railway from Plymouth to Exeter, over the Forest of Dartmoor. By JAMES M. RENDEL, C.E. Plymouth: Stevens, 1840.

This is a well drawn up report, but we can do no more than call attention to the mode proposed of working the inclines, respecting which we may also mention that a similar plan is described in the First Volume of the Journal.

"From the point of divergence of the Tavistock branch, the main line ascends to Dartmoor; the prevailing gradient being 1 in 38, and the plane 5 miles 860 yards. This part would be worked as one continuous plane, by two water wheels, each equal to 160 horse power, constructed at the head of the plane, and supplied with water as hereafter to be described. The rope to be used for drawing the trains up this plane would be what is technically called an end rope, of the whole length of the plane; being very little longer than the rope similarly used on the London and Blackwall Railway, upon which there is an enormous passenger traffic."

"To insure a supply of water for working the water-wheels before described, by which the trains are to be drawn up the two great inclined planes, at a velocity of not less than from 15 to 20 miles an hour, I propose to throw dams across the gorges of the following valleys on Dartmoor, viz.—across the Blackabrook valley east of the prisons of war, the Cowsick valley above Two Bridges, and the East Dart valley, about three miles north of Post Bridge. These reservoirs would have an area of 255 acres, with an average depth of 20 feet, and contain a sufficient quantity of water, during a continued drought, to pass eight trains per day up the planes, for three months; their height above the wheels is from 50 to 300 feet. The great depth of these reservoirs will cause their supply of water to be independent of the severest known frost; whilst from their height above the Railway, the leats by which the water is conveyed to the wheels, will have so quick a descent as to prevent all chance of the passage of the water being interrupted by either frost or snow. The wheels will work under ground, or rather, in chambers under the Railway, and would not therefore be affected by weather."

The Process of Blasting by Galvanism, addressed to the Highland and Agricultural Association of Scotland. By MARTIN J. ROBERTS, F.R.S.E.

In mentioning that Mr. Roberts has been as successful in Scotland with blasting by Galvanism, as Col. Pasley has been in England, we say enough for the merits of Mr. Roberts. We may farther observe that this small pamphlet contains in addition to a good description of the process, several illustrative plates.

Scott's Practical Cotton Spinner and Manufacturer. By ROBERT SCOTT and WILLIAM SCOTT. Preston: Livesey, 1840.

We are glad to perceive that a useful class of works by practical men are springing up in the manufacturing districts, and likely to prove of great benefit. The book now before us is a collection of calculations applied to the several parts of cotton spinning machinery, adapted equally to the use of the engineer and the manufacturer. It seems indeed to be a most useful work.

A Glossary of Civil Engineering. By S. C. BREES, C. E., &c. London: Tilt, and Weale, 1840.

Mr. Brees seems to have been so successful with his previous works, and rendered so confident by his good reception by the public, that after a very short interval he is again before us. The present work is one of less pretensions than those usual emanating from his pen, being a glossary of the terms used in civil engineering, adapted for popular use, and that of the younger members of the profession, and very useful as a handbook of reference. It is copiously illustrated with woodcuts, some of them of considerable artistic pretension. We should have wished that Mr. Brees had given a little more room for mining terms, of which a manual is much wanted.

The Martyr's Memorial, Oxford. By S. S. SCOTT, and W. B. MOFFATT Architects.

This fine monument is an elevated cross in the pointed style, of majestic proportions, having in the second story statues of the three bishops. The cross is raised upon a series of steps, and we are glad to observe without an iron railing round it. The irregular pinnacles of the church in the back ground are made by the cross to look rather awkward, and should be made more symmetrical—we should suggest, by the gentlemen who haye so well fulfilled their previous task.

Ricauti's Rustic Architecture, No. 5. London: Grattan and Gilbert, 1840.

Mr. Ricauti goes on with success in his undertaking, he has shown completely how much beauty may be combined with economy by the simplest means. Even the woodman's axe is an efficient instrument in Mr. Ricauti's hands for giving a picturesque appearance to unbarked trees and small branches. It appears to us that in several of the plans Mr. Ricauti might have greatly promoted the convenience of the arrangements by a few slight alterations.

The Dominican Convent and Chapel at Atherstone, Warwickshire. By JOSEPH HANSOM, Architect.

These buildings were finished in August 1839, and consist of a pile of mixed character in the pointed style. The turret or spire attached to the chapel is a new arrangement of the details of the pointed style, but it appears to us to be rather out of character with the remaining portions.

A Brief Survey of Physical and Fossil Geology. By Frederick John Francis. London: Hatchard, 1839.

This small work is a republication of two lectures delivered at Literary Institutions, and therefore well adapted for popular circulation. The object of such a performance almost places it out of the range of criticism, particularly, whereas in this instance, the work seems carefully compiled.

LITERARY NOTICES.

Mr. Standish Motte, the Parliamentary Barrister, has published at the request of the Aborigines Protection Society, a system of registration for the Aborigines of our Colonies, which, although it recommends engineers to be sent out to the colonies, hardly comes within our province; we can say, however, that it contains many profound and original views.

Mr. Wyld, the Geographer, in addition to his national work on the Campaigns of the English Armies in the Peninsula, has recently published several authentic Maps and Plans of the Seat of War in the East.

Mr. Tyas is about to publish a cheap Map of England in shilling sheets, from the graver of Mr. Jobbins, and on the scale of a third of an inch to a mile. From the specimen it seems likely to prove a useful work.

The new Catalogue of Mr. Weale contains the most copious list yet published of works on engineering and architecture.

NOTES OF THE MONTH.

With the rage for promenade concerts, it is scarcely surprising that architecture should have been a little affected with the mania. The Princess's Theatre in Oxford Street, has been opened at present for concerts; it is a gorgeous building in the style of the revival; finished by Mr. Thomas Marsh Nelson; the original design, we believe, being by Mr. Duncan. The ground in Leicester Square, next to the Zoological Society, is being cleared preparatory to a building for promenade concerts.—The Adelphi Theatre has had a new front put on, we believe from the designs of Mr. Beasley. It is a novelty admissible in such a style of decoration, but the pilasters of the lower arch have been unfortunately contracted, from the interference of a neighbour who possesses a right of way.—Oxford Street is being improved by the erection of several new shops on a large scale.—The Architectural Society commenced its proceedings on Tuesday the 3rd.—Mr. Baily has just finished two statues, one of Sir Thomas Brisbane, for New South Wales, and a statue of a distinguished Irish judge for Dublin.—The foundation has been laid of the new Collegiate School at Liverpool.—The British Museum has received several accessions to its Egyptian collections; a fine colossal head has been erected over the doorway, which produces a fine effect.—Considerable stir is being made as to the formation of new railways, but we fear that the Standing Orders will prevent their making much way this Session. Among others we mention, the London and Manchester, the Cambridge and Norwich, through Thetford, the Lincoln and Nottingham, the Devon and Cornwall lines, the Edinburgh lines, one from Mr. Marshall's Slate Quarries to Ulverston.

ON TIDE GAUGES.

Sir—In your October number you have, somewhat incautiously, given insertion to a letter most injurious to my character, signed "James Inglis, London," on the subject of my new Tide Gauge, a description of which was communicated to the Royal Society by the Rev. Professor Whewell, of Cambridge, and printed in their Transactions for 1838.

Divested of those portions of it which, being merely ornamental, may be safely passed over without remark, Mr. Inglis's letter contains an assertion and an implication, to each of which I must give a separate reply. It is *asserted*, that in answer to various letters which I had addressed to Mr. Mitchell, I received from him a description and drawings of his machine, by the aid of which my own was constructed. In reply to this assertion, I beg to state, distinctly and simply, that I never had the slightest correspondence or communication with Mr. Mitchell in my life, either directly or indirectly, and challenge either him or his friend, Mr. Inglis, to produce one scrap or syllable of any letter of mine in evidence of such correspondence. I may also add that I never saw any drawing or description of Mr. Mitchell's tide gauge, and that I have not, at this moment, the least idea of its principle.

The *implication* contained in the letter of Mr. Inglis is, that as my tide gauge was merely a copy taken from that of Mr. Mitchell, with little or no claim either to originality or improvement, it was not only superfluous but unjust that any description of that machine should have been permitted to appear, with my name attached to it, in the Transactions of the Royal Society. On this latter point I cannot do better than transcribe the document itself which was the immediate occasion of my communicating that description to the public. This document was a letter addressed by Major J. B. Jervis, to the Hydrographer to the Admiralty, Captain Beaufort, R.N., and by him enclosed to me, with the following note:—

"*Admiralty, Feb.* 23, 1838.

"My dear Sir—The enclosed note is from the Engineer Officer who has been appointed to succeed the present Surveyor General of India.—Do me the favour to read it, and tell me how far you can assist us, and when.

"Yours very truly,
"F. Beaufort."

(Note enclosed.)

"To Capt. F. Beaufort.—My dear Sir—I rejoice to say that I have found the Court of Directors disposed to give the fullest effect to our wishes in respect of the registry of the Tides, throughout the whole line of coast of India, and wherever their authority extends. I stated my own views to the Chairman, Sir James Carnac, to Mr. Melville, and other influential persons, and fully explained to them that unless the thing were well done, it were far better let alone; whereupon they directed the dispatch and instructions which they had already prepared for the Governor General and Bombay Government to be withheld, and empowered me to arrange with Mr. Whewell, Mr. Lubbock, and yourself, to propose any course of proceeding and measures we thought advisable, and point out the requisite apparatus. With such a magnificent carte blanche, with such superior co-adjutors, it would indeed be a reproach to be either supine or unsuccessful. Mr. Whewell heartily concurred with us on the importance of having the Tides registered with a far greater degree of precision, and at shorter intervals, at several additional points on the shores of India, Arabia, Persia, the Eastern Islands, and China; and was of opinion that at such stations exact meteorological observations should also be made contemporaneously, and these punctually and promptly transmitted home in duplicate every month, to the Admiralty, to the India House, and to the Royal Society. Although Mr. Mitchell's Tide Guage, erected at Sheerness appears to Mr. Whewell to answer sufficiently well for the subordinate stations, he laid great stress on the necessity of something far superior to this, for those stations where it was intended to have more precise and frequent measurements. He spoke to me in terms of high praise, as did also Captain Washington, of Mr. Bunt's apparatus, but said that he much regretted that it had not been published, although he had been in treaty with the inventor to give it to the public with a complete description." ......"It is the chief object of this epistle to move you to write to Mr. B. to publish his descriptions and drawings. Do let me urge you to use all your influence with him in so good a cause,—and if he would permit a working model to be made under his own eye, it would greatly assist the native artificers of India and expedite the construction of the several tide gauges. The Directors would readily defray the expense of such model.

"Yours, sincerely,
"J. B. Jervis."

In compliance with this earnest solicitation, I immediately prepared and forwarded to Professor Whewell drawings and a description of my tide-gauge, which were soon afterwards inserted in the Transactions of the Royal Society. In doing so, I acted in opposition to the advice of some of my scientific friends, who thought that I was entitled to secure to myself the fruits of so much labour and study. A few months afterwards I was requested to superintend the construction of two machines, similar to my own, for the East India Directors, agreeably to the tenor of Major Jervis's letter, already quoted; with which request I also complied without hesitation. These machines were completed and intrusted to the care of two scientific officers in the Company's service, Lieuts. Elliott and Ludlow; who, after visiting Bristol for the purpose of inspecting my original tide-gauge, sailed with the two new machines for India in February last. From one of these gentlemen (Lieut. Elliott, who had, I think, seen Mr. Mitchell's tide-gauge,) I have received several letters, in all of which he speaks of my machine in terms of the highest commendation.

Immediately on the appearance of Mr. Inglis's letter, I inserted a reply to it in several of the Bristol newspapers, and sent a copy of my reply to Professor Whewell, from whom I received the following note:

"*Trinity College, Cambridge, Oct.* 9, 1840.

"My dear Sir—I have received your slip of the Bristol Standard, and am full of astonishment at the malignant absurdity of Mr. Inglis. Even on his own letter his conduct has this character; for no amount of correspondence with Mr. Mitchell could have deprived your machine of its vast superiority."......"I am glad you have replied to him so calmly. Captain Beaufort's and Major Jervis's letters must satisfy every body, and do you justice."

I now beg leave to request of you, Mr. Editor, that you will write immediately to Mr. Mitchell, and inquire of him what letters of mine he is able to produce in confirmation of Mr. Inglis's statements; whether he acknowledges any friendship or acquaintance with that gentleman; and whether he will favour you with his precise address: and when you have received Mr. Mitchell's reply, that you will be pleased to communicate it to the public.

I am, Sir, your obedient servant,
Small Street Court, THOS. G. BUNT.
Bristol, October 15, 1840.

[In addition to Mr. Bunt's letter, we may ourselves mention that we have written to Mr. Mitchell, and received from him a complete denial that he was ever in correspondence with Mr. Bunt, or that he authorized Mr. Inglis to circulate such statements. In closing this correspondence, therefore, which must be most satisfactory to the claims of Mr. Bunt, we have to express our regret that we should, by the insertion of Mr. Inglis's unfounded charges, have been the means for a moment of raising a doubt as to the originality of Mr. Bunt's invention. We must say that we have never seen a case of grosser or more wicked representation than this by Mr. Inglis, to call it by no other name, and we cannot forbear expressing our severe reprobation of such unwarrantable conduct. We hope that, if he has any feeling of shame about him, he will see the propriety of apologizing as publicly to Mr. Bunt as he has been the means of annoying him.—EDITOR.]

STATE CAPITOL AT RALEIGH, U.S.

SIR—Under the head of AMERICA, at page 52 of the volume of 1837-'8 of your learned work, entitled "*The Civil Engineer and Architect's Journal,*" the *State Capitol* in this city is introduced to the attention of your readers, in an extract of a letter from Ithal Town, Esq., Architect, dated New York, Nov. 3, 1837.

As a Senator, myself, of the State Legislature which ordered its erection, and residing on the spot, I have watched its progress with pride and pleasure, and beg leave to tender to you my thanks and those of my State for even that brief notice of this noble edifice, confessedly unrivalled by any State Capitol in this country. But as I am very sure your readers, and especially artists, would be pleased to see in your Journal a more full and satisfactory description of the building than Mr. Town's letter furnishes, I here copy such a description from the "*Star,*" a weekly newspaper published in this city, and dated 25th March last. It was furnished for publication, at the request of the editor of that periodical, and is known to be from the pen of David Paton, Esq., some years since of Edinburgh, Scotland, the ripe scholar and scientific architect, under whose daily and untiring supervision and direction, for 5¼ years past, this great public work has been executed, and is now nearly completed—a work which entitles him to rank among the first architects, theoretical and practical, of this or any other country, and his private virtues and retiring worth, claim for him universal esteem.

I would not, if I could, detract aught from Mr. Town; his professional fame is the property of my country; but then, "let justice be done, though the hearers should fall." I can not, I will not, conceal the fact, that Mr. Town is mistaken when he supposes that the architectural honour of this fine building belongs to him. It is an honour, indeed, of which any artist might be proud, because it is so perfect and durable a monument of his fine taste and great ability. But this honour belongs to David Paton, Esq., and to none else—and it will wear well, because he has earned it well, and left to others and the work itself, to inscribe his name upon the scroll of fame. Mr. Town did, indeed, furnish a draft for the building, and, likewise, most fortunately for the people of this State, engaged the services of Mr. Paton, 10th Sept., 1834, to execute it; but he is probably unaware that his draught was laid aside, and the whole of the details, alterations, and working drawings, made and executed by Mr. Paton himself. But to the description:—

"The length of the State Capitol in this city, (Raleigh) from north to south, is 160 feet, and from east to west 140 feet; the whole height is 97½ feet. The columns of the east and west porticoes are eight in number, and are 5 ft. 2½ in. in diameter, and 30 feet high, and standing on a stylobate 18 feet high, which, as well as the entablature, which is 12 feet high, are continued round the building; and the details are of the Temple of Minerva, commonly called the Parthenon, which was erected in the Acropolis of Athens, under the government of Pericles, about 500 years before the Christian era. The Rotunda, in the centre of the Capitol, is formed into an octagon at top, which is built of polished granite and surmounts the building, ornamented with Grecian cornice, and its dome is crowned at top with a decoration similar to that of the Lanthern of Demosthenes at Athens.

"The interior of the Capitol is divided into three stories. The basement consists of ten rooms, eight of which will be soon occupied by the Governor, the Secretary of State, the Comptroller, and the Public Treasurer; each having two rooms of the same size and finish, which, as well as the corridors, are of the Roman Doric, and are completely fire-proof, by arches springing from pillars and pilasters of polished granite. The east and west vestibules are richly decorated with granite columns, antæ and staircases; all of polished granite, copied from the Ionic Temple of Ilissus, uear Athens; also two committee-rooms.

"The second or principal story consists also of ten rooms, two of which are appropriated, one for the Senate Chnmber, and the other for the Hall of the House of Representatives, which are 38 ft. 6 in. in height, having galleries, and their walls are contained in areas of the same size, 59 ft. by 55½ ft., having retiring rooms taken off the corners, four in the former, and two in the latter. They, as well as the rotunda and vestibules, are respectively of the octagon Tower of Andronicus Cyrrhestes, of the Temples of Erechtheus, Minerva, Polias and Pandrosus, in the Acropolis of Athens, near the Parthenon. The other rooms on this floor are appropriated for committee rooms.

"The third, or attic story, contains a room for the Supreme Court of the State, and one for the State Library, which are situated in the east and west wings; which, as well as the galleries and other apartments, will be approached by granite steps, and the lobbies and Rotunda are lit with cupolas; the whole of which is now in progress, so as to be ready for the next meeting of the Legislature.

"Before concluding, it may be well to remark that the stone with which this edifice is constructed is of the toughest and hardest description, containing less iron than any stone I have ever seen; hence it presents a beautiful cream colour, of a much warmer tint than marble. It is also variegated with beautiful veins of quartz, the conformation of which deserves notice, having every appearance of having been separated and again knit, by some trembling or concussion in its formation; and from the circumstance of no petrifaction being as yet discovered, whether of the animal, vegetable, or mineral kingdoms, geologists would term it a primitive, if not a transition, formation.

With regard to the cost of the Capitol; the Legislature have appropriated 500,300 dollars; it may cost a little more by the time it is finished. The President's house at Washington cost, without furniture, 665,527 dollars; and the Federal Capitol cost 2,596,500 dollars, both of which have to be repeatedly painted, at a cost of upwards of 12,000; and this has to be done to prevent the disintegration of the stone, they being built of soft, loose, friable and porous sandstone.

ARCHITECTUS."

City of Raleigh, North Carolina,
United States of America. J. B. HINTON.
22nd November 1839.

RECOVERY OF THE CHAIN CABLE OF HER MAJESTY'S SHIP HOWE, AT SPITHEAD.

THE chain cable of the Howe having by an unfortunate accident run entirely out of the hause-hole on Friday morning last, after the anchor was cast, and fallen to the bottom, a creeper was employed to discover it, which grappled it near the buoy over the anchor. On Saturday afternoon, in compliance with a request communicated by one of the lieutenants of the Howe, Colonel Pasley sent a boat to the spot with Mr. George Hall, one of his most expert divers, and a party of men employed about the wreck of the Royal George, to attend him, who threw out a small anchor near the Howe, and then moored their boat in the supposed direction of the chain cable, by making fast a line from the stern of the boat to that cable's buoy. Mr. Hall then descended by the rope attached to the creeper, by which he found the chain, and from that point walked along the whole extent of the chain until he reached the extreme end of it, to the last link of which he made fast one of the bull ropes that had been used for weighing the fragments of the Royal George, by means of which Mr. Purdo, master-attendant of Portsmouth dockyard, and Mr. Taylor, master of the Howe, with a strong party of seamen and marines, got up the end of the chain cable first into a mooring lighter, and in the course of about two hours afterwards it was passed thsough one of the hause-holes of the Howe and properly secured. Mr. Hall went down to the bottom about half-past 2, and finished his task about 4 o'clock, and only came up twice in the mean time, to communicate with the men in the boat. It is supposed that he walked at least 200 yards along the bottom, and during this period the boat with the pump, which was constantly at work to supply him with air, being warped along in the same direction, according to signals made by him from below. This is the second time that this excellent diver has been of use to the navy at Portsmouth, having on a former occasion examined the bottom of the Vanguard after she took the ground on being towed out of harbour by the Echo steamer. As this difficult operation required him repeatedly to pass head foremost under the keel of the Vanguard, he performed it in Mr. Siebe's improved tight diving dress, but in recovering the cable of the Howe, which was comparatively an easy task, he used the common diving dress, in which he has generally worked on the wreck of the Royal George, leaving Siebe's dress to the divers of the Royal Sappers and Miners, who have been employed on the same wreck for the last three months, and whom it was desirable to send down in a tight dress, as being the safest, they not having had any previous experience like the professional divers with whom they have been co-operating.

NEW INVENTIONS AND IMPROVEMENTS.

Improvements in Steam-engines and Steam-boilers; patented by Thomas Craddock, of Broadheath, near Presteign, in the county of Radnor, Sept. 16. —The improvements in steam-engines consist, first, in an improved mode of obtaining a rotary motion from the rectilinear and reciprocating motion of the piston rod; and, second, in an improved method of condensing steam.

The improvements in boilers consist in an improved construction of boiler, and in an improved method of regulating the generation of steam.

First claim is to the mechanical arrangement of the apparatus delineated and described, whether employed for converting the rectilinear into the rotary motion, or the rotary motion into the rectilinear. In this improvement the piston rod carries two toothed racks, one being behind, on one side of the other; one of these toothed racks works into a pinion, which pinion takes into the teeth of a drum, which is firmly keyed on the main shaft, which drum has teeth over half its circumference on one side, and over the remaining half of its circumference on the other side. The mode of working is as follows: by the up-stroke of the piston-rod, the pinion, taking into the teeth on one side of the drum, brings it half round, and is released; then by the returning stroke of the piston-rod, the other rack takes into the teeth on the other side of the drum, and finishes the stroke in the same direction.

Second claim is to the exclusive right of condensing the steam or vapour of water, or other liquids, by causing it to pass into metallic tubes of small diameter, or into metallic vessels of any other suitable figure, which tubes or vessels are put in motion, either rotative or otherwise, either in air or water, independently of any motion of the carriage, boat, or vessel, to which the condenser may be attached, whereby the condensation of the steam or vapour is greatly accelerated. This condenser is composed of two chambers, connected by a bar, and supported by hollow axes revolving in bearings, which axes are connected, the one with the eduction pipe of the engine, the other with a hot well or reservoir. From each chamber a number of hollow arms diverge, which are connected together by small tubes, reaching across several times.

The condensing is performed as follows: the steam, after operating on the piston, is introduced through the chamber into the tubes; the condenser is then caused, by bearings from the engines, to revolve with great rapidity, by which means the caloric is abstracted and the steam condensed; the water resulting from which is conveyed from the other chamber, into which it flows, through a pipe into the hot well; from whence it is drawn by the feed pump into the boiler.

Third claim.—The construction and arrangement of the parts constituting the boiler.

Fourth.—The use of a separate cylinder to supply both air and fuel to the furnaces, and regulating the supply of steam to the cylinder by the pressure of steam in the boiler, in such a manner that as the pressure increases, the supply of steam to the cylinder is diminished, thereby diminishing the supply of air and fuel to the furnace. The boiler is composed of two furnaces, the sides of which are formed of ranges of hollow tubes, which are full of water, communicating at the top and bottom with rectangular reservoirs; the bottom is formed of smaller tubes, extending horizontally from one reservoir to the other, and acting as fire-bars; the top is likewise composed of tubes extending from one reservoir to the other; the ash-pit is a tank filled with water, which, by the heat from the fire-bars, evaporates, and passing up a tube into the condenser, is there condensed; thereby supplying any loss from leakage. The fuel is conveyed into the furnaces by shoots from two hoppers; upon being thrown into the hopper, it falls upon two fluted rollers, which are worked by the pinion that drives the fan; it then falls through or between these rollers, and down the shoot upon a swinging plate, which scatters it over the surface of the fire. The wind passes from the fan through a pipe to the bottom of the fire-bars. When the steam gets beyond the regular working pressure, it shuts the valve which supplies the fan cylinder with steam, and escapes through another opening into the atmosphere, whereby the pinion that works the fan is either stopped, or works very slowly, by which means the supply of air and fuel to the furnaces is very much decreased or cut off altogether; when the steam has returned to the regular working pressure, it is again admitted to the fan cylinder, which works as before. There is a suitable opening, provided with a cover, for the admission of the fire, and likewise a tube with an eye-piece of talc for viewing the fire when required. There is likewise a contrivance for burning the smoke arising from the coals when newly thrown on the fire; it operates in this manner—there is a tube which communicates with the two shoots, and at the bottom of each furnace there is a valve for shutting off the supply of air; when one or both of the furnaces have burnt bright, and fresh fuel is required, the supply of fuel and air is shut off from the other one; the smoke arising from the fresh fuel is driven, by the force of the air from the fan, through the flue into the other furnace, where it passes through the fire and is consumed.—*Inventor's Advocate.*

Improvements in the manufacture of iron and other metals; patented by Sir Josiah John Guest, of the Dowlais Iron Works, Glamorgan, Baronet, and Thomas Evans, of the same place. Sept. 28. These consist principally in the introduction of jets of steam into the puddling furnace while the iron is in the state usually called "fermentation." The success of the operation depends very much on bringing the steam in close contact with the melted iron, to effect which, wrought iron telescope tubes, sliding one on the other, are employed, the jet pipe being ¾ of an inch in diameter, and the steam pressure 15℔. upon the inch. These tubes are raised or lowered according to the quantity of fluid metal in the furnace, by means of a suitable lever. In the second place, jets of damp steam are introduced into the refining furnace, after the pig iron is melted, through the same apertures as the blast, the quantity and pressure of the steam being regulated by the quality of the metal acted upon. During this process, in order to keep the sides, bridge, and bottom of the furnace from burning, a quantity of steam is introduced upon the fluid cinders as soon as the heat is drawn, until the cinders become of the consistence of paste; this paste is then raked up against the back, sides, and bridge of the furnace, so as to fill up any cavity that may have been burned during the previous heat of iron. The use of cinders in this state keeps the iron quite clean and free from the dirt which always attends the use of clay and limestone. In this instance four jet pipes are used, ½ an inch in diameter, and steam of 20℔. on the inch. The steam may be generated in a tube or cylinder in the furnace chimney, or may be supplied from a regular steam boiler. The employment of steam in a similar manner in melting the alloys of copper and iron, and iron and tin, is also claimed, but the particular application is stated to be to the manufacture of iron, whereby a better material is obtained with greater economy. The claim set forth is for the use or application of steam forced upon or into, or in contact with the melted iron in the refining or puddling furnaces for the manufacturing of the same; also for the similar use of steam in the process of melting or manufacturing alloys of copper and iron, and of tin and iron, in such furnaces; and lastly, the application of steam to fluid cinders as described, to produce the paste aforesaid; and the use and application of the said paste.—*Mech. Mag.*

Improvements in preparing surfaces of paper; patented by Henry Martin, o Morton-terrace, Camden Town. Sept. 30. The processes constituting these improvements, are fourfold, viz.: 1. The mode of preparing surfaces of paper by combining thereon a coating of oil paint, with subsequent embossing as afterwards described. 2. The mode of preparing surfaces of paper in the manufacture of paper-hangings, by combining thereon a coating of oil paint, and afterwards printing or producing thereon the required pattern. 3. The mode of preparing surfaces of paper by combining thereon a coating of oil paint, and subsequently glazing or planishing the same. 4. The mode of producing a coating of oil paint on paper, by means of rollers. The paint used for this purpose is the same as ordinarily employed in house painting; a piece of paper of 12 yards, or other required length, is to be laid upon a table of similar dimensions, sized with one or two coats of common or superior size, and then painted with an ordinary brush; while yet wet, the surface is to be smoothed over with a dry brush, to take out the marks left by the first, and subsequently finished with a badger softener, which produces a smooth and level surface, so essential to the success of this process. In the other process, oil colour is laid on the surface of paper by passing it between two rollers, together with an endless felt; this felt in its revolution is supplied with oil colour by passing into a trough, and under a roller partly immersed in the colour; a scraper removes the superfluous colour as it rises, and levels and equalizes the colour; the paper is passed through the rollers two or three times, according to the thickness of colour required. Paper thus prepared on the surface, may be embossed with engraved dies or rollers in the usual manner, or printed with blocks, &c., for paper hangings, which may be washed with soap and water when soiled. If marbled paper is to be produced, the colours are thrown upon water in the usual manner, the effect being increased by softening off before they are dry. If the surface is to be glazed or enamelled, the oil colour is thinned wholly with turpentine, as a flatting colour; when set, it is to be mounted on a woollen cloth, cotton velvet, or other firm soft bed, and smoothed over with a pallette knife, or trowel having a very smooth surface; when dry and hard, the polish may be heightened by any of the usual methods, which will produce a beautiful surface for copper-plate printing, paper hangings, and various other purposes.—*Mech. Mag.*

Valves for Canal Locks; patented in America by William Lake, Richmond, Virginia, June 7, 1839. The patentee remarks, that "the valves of canal locks are subject to a pressure, the intensity of which is measured by the height of the head and the area of the valves; and this pressure on the common sliding-valves for locks of ordinary lifts is of such magnitude, and requires the application of so great a force to open them, as greatly to detract from the superiority which they otherwise possess."

"My improvement consists in giving such form to the valves and apertures that, by the momentary application of a very small force in opening a small orifice, I apply the hydrostatic pressure in such a manner as to open the valves. Upon the back of the valves closing the aperture through which the water flows in filling and discharging the lock, I attach a flanch of the same length as that of the aperture, and of such a width as to have the same proportion to the width of the valves as the friction of the valve on the seat has to the pressure. At the lower edge of the valve, below the flanch, I make an orifice of about one inch in width and about half the length of the valve; this orifice I open and shut by means of a lever and connecting rod."

We were about to make further extracts from the specification, but find that in so doing we must occupy more space than is convenient to allow to the subject; and after all, should probably fail to give a clear idea of the construction without the aid of the drawing; we, therefore, skip over to the concluding paragraph.

"I have represented the valve as fixed in a lock-gate, but I by no means intend to restrict myself in my said improvement to valves placed in this particular situation; neither do I claim as my invent on the manner of applying the lever and screw as exhibited in the drawing. What I do claim as my invention, and desire to secure by letters patent, is the application of the hydrostatic pressure, to open sliding valves for canal and river locks, and making such improvements in the construction of the said valves, and in the form of the apertures to which they are applied, as will adapt them to the application of this pressure, as herein described."—*Franklin Journal.*

RAILWAY CAUTION.

Sir—Being a frequent traveller on railways, and generally choosing the slow trains, I beg leave to trespass on your valuable columns by suggesting an expedient by which, in my humble opinion, travellers situated like myself may avoid the disagreeable necessity of being run over by quicker trains. The plan to which I allude is this:—that at each station on the line of railway be placed a large dial, similar to a clock face, with minutes marked upon it from 1 to 60. It should have one moveable hand of sufficient size to be distinctly visible to the guard and engineer as they fly past; the officer in attendance to fix the hand at that particular number on the dial that may denote the number of minutes which have elapsed since the preceding train passed. This signal might be illuminated at night. Or a perfect clock face might be adopted to denote the hours in addition to the minutes.

I am, Sir,
Your obedient servant,
T. W.

Kennington,
Oct. 24th, 1840.

ROTARY ENGINE.

An engine, upon this principle, was latelytried in Leeds, in the presence of several engineers. Its enormous power, in so small a compass, (the whole machinery, with the exception of the fly-wheel, being contained in a box 2¾ inches in depth and 10 inches diameter) surprised every one present; the speed was tremendous, making from 600 to 700 revolutions per minute. Its power was tested by placing breaks upon the fly-wheel, which was done to the extent that the shaft was actually twisted in two pieces, but no accident occurred. It is the intention of the inventor to apply the machine to propel carriages on common roads, for which purpose it appears admirably adapted; likewise for the purposes of marine navigation, where the small quantity of room it requires is a material consideration; in short, it will answer all the purposes wherein steam is required; and the expense will be considerably abridged. The inventor is Josh. Briggs, watchmaker, of this town.—*Leeds Intelligencer.*

STEAM NAVIGATION.

INCRUSTATION STEAM ENGINE BOILERS.

We are informed by *L'Echo du Monde Savant*, of the 25th of July, that M. Edouard Richard had presented to the Geological Society of France a calcareous incrustation, which must be considered of great value, as it was not formed in the boiler, but in the cylinder of the engine, and beneath the piston. The incrustation formed a disc 12½ centimetres in thickness; and in consequence of the pressure of the piston, it is so hard that it is capable of receiving as high a polish as the densest marble. It is evident, therefore, that explosions may be produced as well by calcareous concretions of the cylinders as of the boilers of steam engines. The engine from which this specimen was procured, has been used for the purpose of pumping water from the mine of Auzin, and has been built after Newcomen's plan.—In *L'Echo du Monde Savant* of August the 5th, we find a communication upon the subject of steam-boiler explosions by M. Flesselle, a retired officer of the French Marine, resident at Graville, near Havre. M. Flesselle suggests, that, in order to prevent the formation of calcareous incrustations, (which have long been considered the principal causes of accident,) some common salt or muriate of potash, should be put into the boiler with each fresh supply of water. M. Flesselle recommends this measure, because the incrustations are formed of the carbonate, the sulphate, and perhaps the phosphate of lime—(salts, insoluble, or sparingly soluble); and these salts, boiled with the muriate of soda (common salt), or muriate of potash, will undergo double decomposition with these muriates; the products being the carbonate, sulphate, and phosphate of soda, and the muriate of lime—salts all of which are soluble.

M. Flesselle says that M. Chaix, of Maurice, has invented a method of preventing explosions, which appears to have been adopted with success in the French government steam vessels; but M. F. considers that auxiliary means also are requisite—and we think he is right; for the fact we have related regarding the engine at Auzin, proves that we should avail ourselves of every cheap and simple aid to prevent the fearful accidents to which incrustations may give rise, seeing that the sulphate, carbonate, and phosphate of lime may be held in suspension by the steam—be carried by it in a state of minute molecular division even into the cylinders—and there also be deposited in the form of hard concretions.—The method of M. Flesselle, seeming founded on correct chemical principles, will, we hope, be put to the test of experience, by some of the numerous engineers of our neighbourhood. We shall feel great pleasure in recording the result.

In England the precaution taken against incrustations is an index of the density of the fluid in the boiler; but this is evidently inadequate—for the calcareous particles are conveyed by the steam into the pipes and cylinder. Perhaps some of our scientific readers will have the goodness to inform us whether the English method of preventing incrustations is identical with that of M. Chaix.—*Gateshead Observer.*

THE PROPELLER STEAM-BOAT.

This vessel was built in the yard of Mr. Dichburn, at Blackwall. The engine by which her paddles, or propellers, as they are termed, are worked, was made by Mr. Beale, the engineer, at his premises at Greenwich. She is a small vessel, but very elegant in her proportions, and formed to cut through the water with great rapidity. The engine is of 24 horse power. The propellers differ from the paddle-wheels used by other steamers, in being single blades of iron, only one blade on each side of the vessel, and not a series of blades brought into the water by the revolution of wheels. Each blade is very broad and large, and dips almost perpendicularly into the water, so that the concussion formed by the blades of paddle-wheels dipping into the water at angles is avoided, and the consequent unpleasant vibration of the vessel. Directly the blade dips into the water it is forced back by an arm or limb of iron, performing a motion similar to the leg and web-foot of an aquatic bird, and by means of this motion the vessel is propelled forward. She can perform from 10 to 11 knots or miles an hour. The appearance of the propellers is like that of the legs of a grasshopper, and when in motion their action in some degree resembles the legs of that insect in its walk. One great advantage is, that the propellers occasion no swell in the water, no wake or trough in the river, and no backwater, so that no danger is occasioned to small boats by the rapidity of her progress. This vessel now runs hourly between Blackwall and Greenwich, and appears to be a great favourite, from the number of passengers she is continually conveying backwards and forwards between those places.—*Times.*

Iron Steamers.—Another iron steam vessel was launched from the yard of Messrs. William Fairbairn and Co., at Millwall, on Tuesday the 27th ult., being the second of three vessels for New South Wales, intended for the trade from Sydney to the Hunter's River. She glided gracefully into the water amid the cheers of a number of spectators, and of nearly 600 men who are employed on the premises, and was named *The Thistle.* She is 145 feet long, 20 feet 6 inches beam, and 11 feet 6 inches depth of hold, about 305 tons burthen, and drew when launched only 3 feet 6 inches of water upon an even keel.—*The Rose,* the first of the trio, has sailed for her destination, and she proved herself before leaving the river to have a speed of 13½ miles per hour, and to be one of the strongest and best sea going vessels afloat. The frames of these vessels were much admired on account of their great strength, as well as the manner in which the whole was put together. The engines, which are of 50 horse power each, were also manufactured, and the whole of the fittings executed by Messrs. Fairbairn and Co., within the same premises. The extent of work which was in progress in the yard, and in the engine manufactory, &c., seemed to surprize many of the gentlemen present, who remembered the place in which these operations are now carried on as a piece of marsh land overflowed by the tide little more than four years ago. Within this period the whole of the extensive workshops and iron foundry have been built. Thirty-one iron vessels, to the amount of 6100 tons have been constructed, and steam engines to the extent of 1260 horse power have been manufactured.—An iron schooner intended for the coasting trade from London, and various steam boats, are now in course of preparation, so that it seems this material is making rapid strides in the public estimation for the purposes of ship building.

War Steamer.—It will be recollected that the steamer of war *Polyphemus,* of 800 tons burthen, was launched at Chatham, on Monday the 28th of September, the same day that the *London* of 92 guns was launched, the former vessel proceeded up on the following Thursday, the 1st of October, to the engineering establishment of the Messrs. Seawards and Capel, of London, and they have completely equipped this fine vessel with engines of 200 horses power, with all her fittings, spare gear, implements and stores, and coal boxes of wrought iron to contain 220 tons of coals, in the short space of 22 working days; being the shortest time upon record that a vessel of this magnitude has been fitted. She proceeded down by steam to Chatham on Wednesday the 28th instant, to take in her masts, being quite completed in her machinery; it is considered that it would require a period of six months in any port of

Great Britain to fit a vessel of war of the same magnitude. There were about 220 men employed by the Messrs. Seawards on the vessel; her engines are upon the same system as those of the "Gorgon, Cyclops, Alecto and Prometheus." The "Polyphemus" will be immediately armed with two 10 inch guns, and will proceed directly to the Mediterranean.

Navigation of the Trent.—An attempt is about to be made to revive the steam navigation of the river Trent. There were packets on the river about twenty years ago, but the extreme shallowness of the water in dry seasons between Nottingham and Newark, frequently interrupted the navigation.—*Hull Advertiser.*

Great Western Steam Ship Company.—We understand that some of the experimentalizing Directors of this Company, have resolved on adopting the Archimedean screw for the great iron ship, and are now reconstructing her at an enormous expense, for that purpose. We need hardly observe, that this course has been adopted without the sanction of the Proprietors.—*Bristol Mirror.*—[How many more changes and whims?]—Ed. C. E. & A. Journal.

Steamers in the Pacific.—Extract of a letter from Captain Peacock, dated on board the Pacific Steam Navigation Company's steam vessel *Peru*, lat. 9 15 N., long. 25 50 W., out 14 days from Plymouth:—"The *Peru* has hitherto had a most prosperous voyage, answering in every respect my most sanguine expectations."

Calcutta.—A Company has been formed at Calcutta for establishing two steam ferry boats upon the river Hooghly with chains, upon the principle of Mr. Rendel's floating bridges at Plymouth, Portsmouth, and Southampton; and orders have been sent to this country for their purchase. We have great pleasure in stating, that the contractors are Messrs. Acraman, Morgan & Co., of the Bristol iron works; their competitors having been Messrs. Fairbairn, of London, and Messrs. Jawcett and Co., of Liverpool.—*Bristol Mirror.*

Sicily.—On Thursday, the 15th ult., was launched at Mr. Pitcher's yard, at Northfleet, the *Mongibelle*, a vessel of 500 tons burden, for the service of the Steam Navigation Company, for the kingdom of the two Sicilies. It is intended to fit the *Mongibelle* with a pair of Messrs. Maudslay, Sons, and Field's patent double cylinder engines, of the collective power of 200 horses.

America.—Two large steam-ships are building at New York for the Spanish government, and one for the Russian. Mr. Norris, the engine manufacturer of Philadelphia, has received an order from Frankfort-on-the-Oder for 15 of his best locomotives. Thus American ingenuity in steam machinery is prospering.—*Times.*

Canal Steam Navigation.—The experimental steamer, at present on the Forth and Clyde Canal, was lately docked for the purpose of making certain alterations on the propeller. On the former occasion the floats were fixed at an angle of 45 deg. to the shaft of the propeller, which gave, of course, a progressive motion from six feet in each revolution, the diameter of the propeller being two feet. On the present occasion, the floats were placed on the shaft at a more obtuse angle, so as to reduce the progressive motion six to four feet. On Friday week, the boat was got under way from Lock 16. To conduct to a satisfactory conclusion, of course, the pressure of steam in the boiler was made the same as on the first experiments, viz., 54 lb. on the square inch; and the result of this change in the angle of the floats to the shaft, was found to be an acceleration of speed of 20 per cent., or rather more, as compared with the first experiments. That is, when the floats are placed at an angle of 45 deg. upon the shaft, the speed was found to be five miles an hour; now, when the angle was rendered more obtuse so as to produce four feet progressive motion, it was found that the speed was at the rate of six miles an hour. The result was extremely satisfactory to all the gentlemen present, confirming, as it did, their former anticipations; and the boat has again been laid up preparatory to other alterations which are contemplated, in order, experimentally, to demonstrate the most efficient angle at which the floats should be placed upon the propelling shaft.—*Paisley Advertiser.*

Improvement in Ship-building.—The *Roseanna*, a new ship, lately built by Mr. Jackson, at the South Shore, is the first vessel ever entirely fitted with iron lower-deck beams. They are remarkable for their strength and neatness, and above all, give additional room for stowage, equivalent to 12 inches depth of hold. It is by such practical combinations of wood and iron that we may expect to compete with other nations more highly favoured with shipbuilding; and we advise every man who takes an interest in the "wooden walls" to go and judge for himself. The *Roseanna* lies at the south-west corner of the Brunswick Dock.—*Liverpool Albion.*

ENGINEERING WORKS.

New Aqueduct at Dijon.—It is stated in a letter from Dijon, that the experiment made there of the aqueduct which is to conduct the water from the fountain of Rosoir to Dijon, a distance of 12,610 metres (about 13,700 yards) completely succeeded. Crowds of people assembled on the day the aqueduct was to be opened, to wait for the coming of the water, which was three hours and a half in flowing through that distance.—*Inventors' Advocate.*

The Fleet Sewer, Blackfriars Bridge.—A meeting of the City Commissioners of Sewers took place at Guildhall on Tuesday the 13th ult., for the purpose of taking into consideration Mr. Walker's plan of a culvert at the mouth of Fleetditch, adjacent to Blackfriars Bridge, as a remedy for the very great nuisance occasioned by the want of some scientific application. After some discussion in the committee, the Commissioners of Sewers agreed to the adoption of Mr. Walker's plan of the culvert by a majority of about 15 to 3. The apprehensions so generally entertained of the opposition of the Commissioners of Sewers to the enlightened project of the President of the Civil Engineers, are thus very agreeably and permanently removed.

Herefordshire and Gloucestershire Canal.—A general meeting of the proprietors of this canal was lately held at Ledbury. The report on the state of the works was very satisfactory, the committee expressing their conviction after a careful survey, that the main part of the line between Ledbury Wharf and Ashberton, upon which the heaviest portion of the works occurred, would be completed within the estimated cost, notwithstanding that the payments for land had been much larger than was expected. The three locks, communicating with the summit level, would be completed before November next, when the trade of the canal would be brought up to the town of Ledbury, from which an immediate increase of traffic was anticipated, and by the end of August, next year, the canal would be opened for the conveyance of goods to the distance of 7½ miles beyond Ledbury, by which extension the trade would, in all probability, be doubled, if not trebled. When it was recollected that the present annual average receipts of the canal, subject as it was to suspension and loss of trade for many months of the year from want of water, was £1,800, the committee anticipated a profitable traffic on the completion of the whole of the works. The estimated expense of the line to Hereford was £76,000, of which sum £45,000 was to be raised by preference shares, and they recommended that the remainder should be obtained by mortgage at five per cent. upon the tolls of the canal. The report concluded by a reference to the completion of the Birmingham and Gloucester Railway, which would open a direct communication with all the large manufacturing towns of the north, and thus operate most beneficially upon the interests of the canal. By the statement of accounts presented to the meeting, it appeared that the receipts amounted to £21,477 5*s.* 5*d.*, and the expenditure to £21,296 3*s.* 4*d.*, leaving a balance in hand of £181 2*s.* 1*d.* Mr. Ballard, the Company's engineer, read a satisfactory report on the state of the works, the leading features of which are embraced in the statement of the committee. The report was unanimously adopted, and a resolution passed for raising the sum of £35,000, in the manner suggested by the committee. Votes of thanks were then passed to the committee (who were re-appointed for the current year) and to the Chairman, after which the meeting separated.—*Midland Counties Herald.*

PROGRESS OF RAILWAYS.

Dublin and Drogheda Railway.—We are happy to announce that the Dublin and Drogheda Railway Company made their first contract on Friday last. The Messrs. Jeff of Lanarkshire were declared the contractors for the part of the line between the Royal Canal and Raheny, on very favourable terms for the Company, and for an amount less than the estimate of Mr. Macneill, the engineer-in-chief. The competition was a very brisk one, there being no fewer than seventeen tenders for the work, and from some of the principal contractors on the great lines in England and Scotland, as well as from some very respectable Irish Companies.—The parties selected have been engaged extensively on the Ballochine Railway, the Monkland and Kirkintilloch Railway, and have just completed a large work to the amount of thirty or forty thousand pounds, on the Wishaw and Coltness Railway in Scotland. Mr. Hart, a contractor on the Great Western Railway at Box, near Bath, made so satisfactory a tender, and so close in amount to that by the Messrs. Jeff, (we hear it was within five pounds.) that the Directors thought it right, with a view of encouraging such competition, to hand him a gratuity of £50, with an assurance that they will be happy to deal with him on a future occasion.—*Dublin Evening Mail.*

Norfolk, Suffolk, and Cambridgeshire Railway.—Considerable exertions are being made in these counties for getting up subscriptions to form a railway to Norwich and Yarmouth, in continuation of the Northern and Eastern Railway from Cambridge. The latter line it is expected will be opened to Bishop Stortford in June next.

West London Railway.—An adjourned general meeting of the proprietors in the West London (late Birmingham, Bristol, and Thames Junction) Railway Company was held in London on the 12th ult., to receive the report of Mr. R. Stephenson, the recently appointed engineer, on the state of the works. The chairman explained that the report of Mr. Stephenson was not yet prepared, but that the secretary would read to the meeting the report of the directors. It stated that it was proposed to make two extensions of the line, one to the Thames, (the original line stopping short of the river by about a mile and a half,) and the other to Knightsbridge; the extensions to be undertaken by a separate company. The directors calculated that £140,000 would be sufficient to accomplish the object, both companies to be amalgamated when the whole of the works were completed, or as soon after the extension company had obtained an act of incorporation as the proprietors of the two bodies might consider fit. The report was unanimously adopted, as was also a series of resolutions in respect to the mode of issuing the new shares for the raising of the additional capital. It was explained that the amount of arrears due upon calls was £14,437. The meeting adjourned to the 14th November, to receive Mr. Stephenson's report.

Opening of the Taff Vale Railway.—The public opening of the completed portion of this interesting and important line, between Cardiff and Navigation House, nine miles from Merthyr, took place on Thursday the 8th ult. The manner in which the works on the line are executed, drew forth frequent expressions of admiration from the party. The tunnel and viaduct at Quaker's Yard are, indeed, noble specimens of engineering skill; the viaduct across the Taff rises to the height of 120 feet, and is built on six massive arches, the masonry of which is in admirable keeping with the character of the surrounding landscape. The tunnel which passes under Godre-y-coed is 500 yards in length; it was brilliantly illuminated for the occasion, and as the company passed through it, preceded by the band, the effect produced by the echoes of its walls and roof, and the glare of upwards of 2,500 lights, was striking and novel in the extreme. The line is differently constructed from the Great Western, the company having, on account of the number of curves which the face of the country rendered necessary, adopted the narrow gauge, and the rails being laid on chairs affixed to transverse sleepers. The travelling is easy, and will safely admit of a speed of from forty to fifty miles per hour. The carriages, which are admirably constructed, were built by our respected fellow-citizen, Mr. Walter Williams, and the two engines at present on the line, the *Taff* and the *Rhondda*, by Messrs. Sharp, Roberts, and Co., of Manchester.—*Bristol Mercury.*

Further Opening of the Manchester and Leeds Railway.—The first portion of this line, which was opened in July, 1839, was a length of about fourteen miles, from Manchester to Littleborough; and on Monday 5th ult., another portion was opened, to the extent of 27½ miles. This portion of the line commences at Hebden Bridge, about nine miles from Littleborough, and terminates at Mormanton, where it joins the North Midland Railway, about fifty miles from Manchester.—*Manchester Guardian.* The *Leeds Mercury*, in noticing the further opening of this line of railway, says,—"We speak on the highest authority when we say, that this railway is the greatest triumph of engineering science over the obstacles interposed by nature, presented by any railway in the kingdom. The high chain of hills which separates the counties of York and Lancaster is only intersected by one valley, namely, the valley of the Calder, and that so narrow and winding, so lined with towns and villages, and so preoccupied by the turnpike road, the river, and the canal, as to make it exceedingly difficult to carry a railway through it. Yet, by embankments and cuttings, by removing rocks and building up arches, by occasionally diverting the river and the road. and often crossing both, by piercing the hills with short tunnels, and taking first one side of the valley and then the other, a line has been constructed not only capable of being worked by locomotive engines, but of being easily and advantageously worked. There are no objectionable curves, and there is not one gradient having half the inclination of those on the Liverpool and Manchester Railway. The line is somewhat circuitous, and this is its only disadvantage; a disadvantage which the speed of locomotive travelling reduces to insignificance. The engineer by whom the line was planned, and under whose superintendenc it has been executed, is the celebrated George Stephenson, whose genius and unparalleled works we have so often had occasion to notice with high admiration. Under him Mr. Gooch, one of his pupils, has been employed as resident engiengineer, and has displayed abilities equal to the execution of the greatest undertakings. The managing director, who has given up his whole time to the superintendence of the work, is Robert Gill, Esq., to whose remarkable energy, zeal, and talent, the company are very greatly indebted for the completion of the work within so short a period."

Birmingham and Gloucester Railway.—The railway from Cheltenham to Gloucester is now completed, or at least one line of rails is permanently laid down through the entire distance, and along these several experimental trips have been made during the past week, wsth the most complete success. The first of these took place on the 17th ult., and the further opening of the line for the public will certainly take place on the day already announced, viz., the 2nd of November.—*Cheltenham Looker-on.*

PUBLIC BUILDINGS, AND IMPROVEMENTS.

ROYAL EXCHANGE.

This building appears at length likely to be commenced; the following tenders for the foundation were received, and that of Mr. Webb accepted.

Webb	8124		
Grimsdale	8738	6	
Cubitt	8984	14	
Little & Son	9423	1	8
Warde	9586	17	
Piper	9979	16	4
Grissell & Peto	10165	5	4
Lee	10387		
Bridger	10627	6	8
Baker & Son	10932	3	4
Bennett	11181	9	6
Winsland	11302	6	8

The New Riding-house and Stabling in Windsor Park.—This extensive building, the expense of which is to be defrayed by the Parliamentary grant of seventy thousand pounds, is now fast approaching towards completion. Some delay has been occasioned in consequence of extensive alterations in the roof of the stabling on the southern side of the riding-house having been suggested by Prince Albert a short time since. The woodwork of the roof of this portion of the building, which was then nearly completed, was observed by his Royal Highness to be discernible (from the interior) through the windows along the top of the south side of the riding-house; and as this was considered to be an "eye-sore," and highly disapproved of the Prince, the building was unroofed and its height reduced upwards of three feet, The riding-house is one of the most extensive in the kingdom; its dimensions being as follows:—height, 38 feet; width, 52 feet; and its length upwards of 170 feet. The frontage of the whole pile facing the Home Park is nearly 300 feet. Numerous bed-rooms for the grooms and stable boys in the service of Her Majesty have been erected over the riding-house. These are of very small dimensions, many of them not being more than ten feet by nine. Their long line of windows extending the whole length of the roof, and discernible from any point a view is obtained of the building, tends considerably to detract from the beauty and general harmony of the structure. Her Majesty and Prince Albert, who have occasionally visited the riding-house and stables during the progress of the works, have expressed themselves much pleased with the economy of the whole of the arrangements.—*Times.*

Improvements on the Exterior of the Mansion-house.—Scaffolding has been erected in front of the Mansion-house by direction of the General Purposes Committee, for the purpose of repairing the dilapidated masonry which has exhibited itself in several parts of the building, which has been vastly improved in appearance by the frequent application of the Bank water engines. The alteration is so great that the walls actually look in some parts as if they were whitewashed. The figures above the pillars, which had been for many years completely hidden under a mass of soot and filth, are now objects of striking interest. As they are in a measure new to the visitors and even the residents in the immediate neighbourhood, we shall briefly describe them. The centre is occupied by a female figure supposed to represent the presiding patroness or genius of the city of London. She holds in her right hand a spear. Her left hand is resting on a shield sculptured with the city arms. She supports a small sculptured castellated tower on head, and is trampling on a recumbent figure, representing her vanquished enemies. On her right hand stands the Roman Lictor and a boy holding the cap of liberty. The extreme right hand angle of the tympanum is occupied by a representation of the superiority of the British empire on the seas by a large reclining figure of Neptune, with his insignia as God of the ocean; and the spaces are filled up with an anchor and cable, &c. On the left of the centre is another female figure, attended by two boys, bearing the olive branch in her right hand, and pouring out abundance from cornucopiæ with her left; the emblems of commerce occupy the extreme angle on the left side, with casks and bales of goods. It has been considered the more necessary to make all practical improvements in the exterior of the Mansion-house, as the new Royal Exchange will much sooner than it is generally expected begin to show itself.—*Times.*

NEW CHURCHES, &c

Boston Wesleyan Centenary Chapel, erected from the design of Mr. Stephen Lewin, architect of Boston, is one hundred feet long, and seventy feet wide between the walls, and is calculated to seat two thousand five hundred persons. The design of the front is Græco Italian; a flight of steps forty-eight feet long, and a colonnade of Ionic columns in antis, and towers at each end, in which are constructed the grand staircases that communicate with the gallery, having steps five feet long, and landings at each angle five feet square; above the staircase are rooms appropriated to the Wesleyan service. There are two main entrances to the body of the chapel through spacious lobbies, with jib doors communicating with the aisles. The ground floor of the chapel contains three divisions of pews, and the sides are provided with free sittings, on each side of the communion is occupied by the schools; the pulpit is approached by two flights of stairs, at the back of the pulpit are vestries with private entrances to the same. The ceiling is forty feet high from the ground floor, it is panneled with ornamented ventilators at the angles, and a block cornice with panneled pilasters round the gallery, uniform with pannels of ceiling; the divisions and doors of the pews, &c., next the aisles are made of wainscot, framed and moulded; the orchestra is formed at the back of the gallery with private stairs and room for the singers.—The building and ground will cost upwards of eight thousand pounds.

St. Michael's Church, Basingstoke.—Extensive alterations are being made in this edifice, which is a fine specimen of the style of Parochial Church of the reign of Henry 6th. It is being entirely repaired and provided with new galleries, &c. to accommodate fifteen hundred persons. The fittings throughout will be of wainscot. The estimated expense is upwards of two thousand pounds, which has been raised by a liberal subscription in the town and neighbourhood, with the Societies for church extension. Mr. J. B. Clacy, of Reading, is the architect. The church is also undergoing extensive repairs, estimated at fourteen hundred pounds, to effect which a vestry last week empowered the churchwardens to borrow one thousand pounds, in addition to a previous rate of about five hundred pounds. This is an example worthy of imitation by other parishes, where, from a false economy, memorials of ancient ecclesiastical architecture are fast mouldering to decay.

Birmingham.—The ceremony of consecrating the church of St. Mathew, at Ashted, the first of the proposed ten new churches to be erected in the town, took place on the 20th ult., it is a spacious and commodious building of early decorated Gothic architecture, built of brick, with dressings to the windows, doors, &c. of Wedley Castle red stone, and also a spire of the same stone. It contains about one thousand and fifty sittings, including four hundred free seats, without side galleries. It was designed by Mr. Thomas, the architect of Leamington, who very handsomely presented a window of stained glass.

Wolverhampton.—The ceremony of laying the first stone of St. Mary's Church, which, with the parsonage house and school attached, will be erected at the sole expense of Miss Hinckes, of Tettenhall, took place in the presence of a very numerous concourse of spectators, on Thursday last. The endowment, which it is understood will ultimately amount to three hundred pounds, and the site, are also the gift of the same benevolent lady; the total cost of the building is estimated at ten thousand pounds.—*Midland Counties Herald.*

Great Haywood.—The consecration of St. Stephen's Chapel, recently erected on a beautiful site given for the purpose by the Earl of Lichfield, in the parish of Colwich, took place last month. It is of very beautiful construction, and reflects great credit on the taste and ability of Mr. T. Trubshaw, by whom ti was designed.—*Staffordshire Gazette.*

MISCELLANEA.

New mode of hanging Pictures.—A very clever and useful invention for the above purpose has been lately patented by Mr. W. Potts, of King William Street, Strand, which we think, as it becomes known, cannot fail of being patronised by all collectors of pictures. The methods of hanging pictures commonly in use are by driving nails into the walls, or running iron or brass rods round the room. Both are objectionable, the former as it damages the decorations, and the latter not only destroying the architectural effect of a well-proportioned apartment, but also that the brackets which support the rod prevent the hooks or cords from sliding to any part wanted. In the patent plan, the means of fixing being above the hooks, they can be moved all round the room with the greatest facility, and necessarily saves much time in hanging or arranging a collection, particularly when any addition is made to it. Attached to the invention are moveable pendant chains and rods, with cross bars and shifting buttons or studs, which can be used or not at the pleasure of the party. Another and very great advantage connected with the plan is, that the rail combines a cornice moulding with the means of supporting pictures, and can be made to form the bottom member of the entablature, as the line in front is not touched either by the hooks, chains, or cord. We cannot but recommend the plan to the notice of architects, as well as to the artist and amateur, as an invention deserving their attention and adoption.

Mr. Junius Smith.—The American papers mention that the degree of LL.D. has been conferred by the University authorities on Mr. Junius Smith, of London, the gentleman whose enterprise, science, and perseverance, have so eminently contributed to the establishment of steam navigation between the old and the new worlds.—*Morning Post.*

Experiment of Large Guns.—On Friday, 11th ult., a party of the Royal Artillery, commanded by Major Chalmers, proceeded to the proof butt in the Royal Arsenal, Woolwich, at 1 o'clock p.m., for the purpose of trying a plan which has been some time in operation in France, for discharging large pieces of ordnance by a hammer and detonating powder, the present system in the British army being with a portfire, ignited and kept burning until the word of command is given. Sir John May, Colonel Dundas, and Colonel Dancey attended to witness the experiment. The gun selected was a 32-pounder, and the charge each time was 10 lb. of powder in a flannel cartridge, with a 32lb. ball fitted in a wooden cup made flat at the end next the powder. Forty rounds were fired, and the simplicity and certainty with which they were discharged gave great satisfaction. The invention is so simple, and might be so easily applied, that there is every reason to believe it will be universally adopted in the Ordnance department. It consists of a small hammer, with a handle about six inches in length, the whole made of brass, acting in holes made in two small pieces of steel fixed by screws to the right side of the gun. The action is given by pulling a piece of cord six feet long, when the hammer falls on the vent charged with detonating powder with such force as to cause instant and certain ignition. There is a small piece of steel to cover the detonating powder, that it may not become wet in rainy weather, and this is so contrived that it falls back the moment the hammer begins to descend.

The New Town of Fleetwood-on-Wyre.—Three years [ago there were only two houses at Fleetwood, and the site of the town was a barren waste overrun with rabbits; now there are 103 houses inhabited to overflowing, and 54 in course of erection. It is said that a considerable quantity of land is purchased for building upon, but there is considerable difficulty in procuring a sufficient supply of brick, stone, and lime, consequently building operations are considerably retarded. We may mention, however, that a small but neat church, capable of accommodating about 400 persons is reared, and that the two shore lighthouses, which will be lighted with gas, are in a forward state, one being about 60 feet high, and the other about 12. As the designs are chaste and beautiful, they will be highly attractive objects to strangers visiting the district. A portion of the iron pier head is completed, and the remainder is in a forward state. There will be a shade erected on the pier for the purpose of keeping the goods, as they are landed, dry, and a line of railway will be laid along the pier, with suitable cranes for the landing of heavy goods; and it is probable that these works will, in the course of a month or six weeks, be so far complete as to enable the Company to commence the carrying trade on a great scale, when a considerable increase of trade to the port may reasonably be expected.

French Steam Engine Factory.—The *Armoricain* of Brest, in giving an account of the Government steam-engine manufactory of Indret, says in its present condition it can only turn out three engines of 160 to 220 horse power per annum, but that Government wishes to increase it, so as to enable it to make annually 12 engines of 450 horse power each. The sum allotted to this establishment last year by Government was 700,000f., but it has now been carried up to 2,000,000f. Six slips for building steamers are attached to the establishment; and a war-steamer, the *Gassendi*, of 220 horse power, is at present building here.—*Galignani's Messenger.*

LIST OF NEW PATENTS.

GRANTED IN ENGLAND FROM 1ST OCTOBER TO 22ND OCTOBER, 1840.

Frederick Payne Mackelcan, of Birmingham, for "*certain improved thrashing machinery, a portion of which may be used as a means of transmitting power to other machinery.*"—Sealed October 1; six months for enrolment.

Thomas Joyce, of Manchester, Ironmonger, for "*a certain article which forms or may be used as a handsome nob for parlour and other doors, bell pulls, and curtain pins, and is also capable of being used for a variety of useful and ornamental purposes in the interior of dwelling houses and other places.*"—October 1; six months.

William Henry Fox Talbot, of Lacock Abbey, Esquire, for "*improvements in producing or obtaining motive power.*"—October 1; six months.

William Horsfall, of Manchester, Card Maker, for "*an improvement or improvements in cards for carding cotton, wool, silk, flax, and other fibrous substances.*"—October 1; six months.

James Stirling, of Dundee, Engineer, and Robert Stirilng, of Galsten, Ayrshire, Doctor of Divinity, for "*certain improvements in air-engines.*"—October 1; six months.

George Richie, of Gracechurch Street, and Edward Bowra, of the same place, Manufacturers, for "*improvements in the manufacture of boas, muffs, cuffs, flounces, and tippets.*"—October 1; six months.

James Fitt, Senior, of Wilmer Gardens, Hoxton Old Town, Manufacturer, for "*a novel construction of machinery for communicating mechanical power.*" October 7; six months.

John Davies, of Manchester, Civil Engineer, for "*certain improvements in machinery or apparatus for weaving.*" Communicated by a foreigner residing abroad.—October 7 six months.

Thomas Spencer, of Liverpool, Carver and Gilder, and John Wilson, of the same place, Lecturer on Chemistry, for "*certain improvements in the process of engraving on metals by means of voltaic electricity.*"—October 7; six months.

Thomas Wood, the younger, of Wandsworth Road, Clapham, Gentleman, for "*improvements in paving streets, roads, bridges, squares, paths, and such like ways.*"—October 7; six months.

Charles Payne, of South Lambeth, Gentleman, for "*improvements in salting animal matters.*"—October 13; six months.

Robert Pettit, of Woodhouse Place, Stepney Green, Gentleman, for "*improvements in railroads, and in the carriages and wheels employed thereon.*"—October 15; six months.

Henry George Francis Earl, of Ducie, Woodchester Park, Gloucester, Richard Clyburn, of Uley, Engineer, and Edwin Budding, of Dursley, Engineer, for "*certain improvements in machinery for cutting vegetable and other substances.*"—October 15; six months.

William Newton, of Chancery Lane, Civil Engineer, for "*certain improvements in engines, to be worked by air or other gases.*"—October 15; six months.

James Hancock, of Sidney Square, Mile End, Civil Engineer, for "*an improved method of raising water and other fluids.*"—October 15; six months.

Henry Pinkus, of Panton Square, Middlesex, Esquire, for "*an improved method of combining and applying materials applicable to formation or construction of roads or ways.*"—October 15; six months.

Charles Parker, of Darlington, Durham, Flax Spinner, for "*improvements in looms for weaving linen and other fabrics, to be worked by hand, steam, water, or any other motive power.*"—October 22; six months.

Richard Edmunds, of Banbury, Oxford, Gentleman, for "*certain improvements in machines or apparatus for preparing and drilling land, and for depositing seeds or manure therein.*"—October 22; six months.

Thomas Clark, of Wolverhampton, Ironfounder, for "*certain improvements in the construction of locks, latches, and such like fastenings, applicable for securing doors, gates, window shutters, and such like purposes.*" Communicated from a foreigner residing abroad.—October 22; six months.

Gabriel Riddle, of Paternoster Row, Stationer, and Thomas Piper, of Bishopsgate Street, Builder, for "*a certain improvement or improvements on wheels for carriages,*" for the term of seven years, being an extension of former letters patent granted to Theodore Jones, of Coleman Street, and by him assigned to the said Gabriel Riddle and Thomas Piper.—October 22.

TO CORRESPONDENTS.

R. *We have some suspicion that the Propeller is not new; we will inquire respecting its originality.*

Robertus. *We have not space for the communication he has favoured us with, containing a list of the "Queen's subjects" whose trades are connected with British shipping.*

Ω *We will take advantage of his communication at some future opportunity.*

S. L. *Designs of a Wesleyan Centenary Chapel were received last month.*

Mr. Kingsford's *plan for a Harbour of Refuge at Dover, we are compelled to omit for the present.*

A Constant Reader. *We cannot inform him.*

Architectus. *His communication from America will appear in the next Journal.*

Book received:—Science of Vision.

We have been obliged to defer until next month the Plan and Section of the Reform Club, *in consequence of the artist not being able to complete them in time.*

The next number for December will complete the Third Volume, and will contain the Title, Preface, and Index. Subscribers are requested to complete their sets of the Journal.

Communications are requested to be addressed to "The Editor of the Civil Engineer and Architect's Journal,' *No.* 11, *Parliament Street, Westminster.*

Books for review must be sent early in the month, communications on or before the 20th (if with drawings, earlier), and advertisements on or before the 25th instant.

The First Volume may be had, bound in cloth and lettered in gold Price 17*s*.

⁂ The Second Volume may also be had, Price 20*s*.

DIRCKS' PATENT IMPROVED METALLIC RAILWAY WHEEL WITH WOOD-FACED TYRE.

Fig. 1.

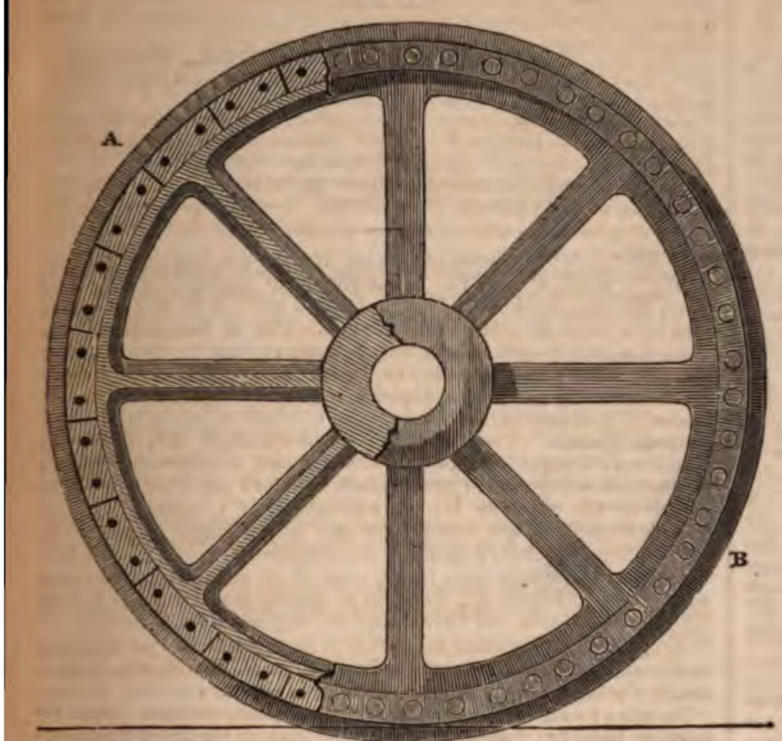


Fig. 2.

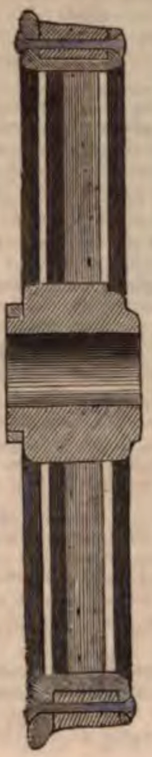


Fig. 3.

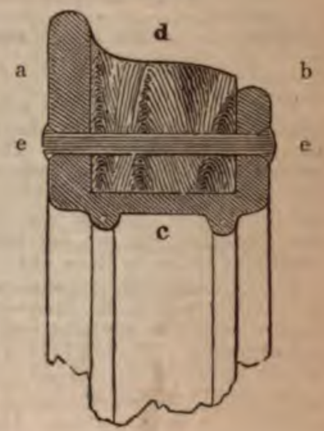


Fig. 4.

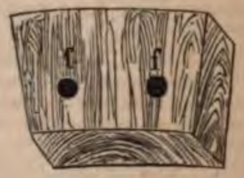


Fig. 5.

Description.

Fig. 1, represents the wheel, half in section, as at A, and half complete, as at B; the view being a front elevation.
Fig. 2, edge elevation, in section.
Fig. 3, showing the channelled tyre *abc*, with the wood inserted at *d*, fastened by the pin or rivet *ee*.
Fig. 4. represents one of the wooden blocks in perspective, perforated with two holes, *ff*, for receiving the pins or rivets.
Fig. 5, cross section of arm of wheel.

Read by Mr. Henry Dircks, before the Mechanical Section of the British Association, at Glasgow, Sept. 19, 1840. *And also before the Polytechnic Society at Liverpool, Oct.* 8, 1840.

As an introduction to the observations immediately relating to the improved wheel which is the subject of the present communication, a few preliminary observations may serve to make its nature and advantages more generally understood.

Wooden wheels were originally in common use on railways; these were afterwards superseded by the extensive use of cast-iron wheels; and both of these descriptions of wheels were much improved by manufacturing them with wrought iron tyres. Modifications of these wheels are still in use on the Liverpool and Manchester Railway, the wooden wheels having the nave of cast iron, and the spokes and rim of wood, the tyre being of wrought iron. On the London and Birmingham Railway, cast iron wheels are extensively used. On the continent of Europe, and in America, cast iron wheels are seemingly employed by preference; and are no doubt quite as safe for travelling, where great speed is not practised.

In England, a decided preference is given to wrought iron wheels, in which this metal is used throughout, with the exception of the boss being *cast* around the ends of the spokes. The latest improvement on these has been the making of the entire wheel, including the boss, of wrought iron.

The wheels now in general use derive their chief novelty from the construction and placement of the spokes, with a view to obtain elasticity, strength, and durability. One variety which does not come under this denomination, is the plate wheel, supposed on its introduction to possess some peculiar advantage in overcoming a supposed resistance of the atmosphere. Except, however, in relation to variations in size, the present wheels are little more than varieties in pattern. The common diameter of carriage and waggon wheels is three feet, and the largest driving-wheels for locomotives are those employed on the Great Western Railway, being six to seven feet in diameter,—though at one time they were made as large as ten feet.

The action of an iron wheel on an iron rail, though derived from a rolling motion, can only be compared to a series of blows, and the rebound occasioned by iron striking iron is well known to be considerably greater than is produced by striking wood on iron. To this simple fact we may trace the tremulous motion occasioned by iron wheels on an iron railroad; and when, by any trifling accident, as an inequality from the rising of one end of a rail, or sometimes even from small flinty pebbles getting on the rail, the rebound is not more fearful than dangerous. The tremulous motion of the rail just adverted to renders it necessary in most cases to lay the rails on wooden sleepers. As an illustration of what is meant, it may be mentioned that on the Dublin and Kingstown Railway the rails were originally laid on granite sleepers, but the tremor was so great as to loosen the rails, and occasion serious fears from the consequent damage sustained by engines and carriages passing along the line. It was, therefore, ultimately agreed to take up the granite and lay down longitudinal wooden sleepers, a work of considerable labour and expense. In some cases the nature of the soil or sub-soil may allow the use of stone blocks; and where they can be applied with safety, they are preferred, for the reason that a road laid on *stone* blocks can be kept up at a lower rate than one laid on *wooden* sleepers; and, as has been endeavoured to be clearly shown, the only reason for laying the stone aside, arises from the tremor imparted to the rail by iron wheels as at present used. Brees, in his Railway Practice (1839), gives, in a copy of an estimate for work on the "North Union Railway," the following particulars, at page 142:—

Maintaining railway crossings and sidings, when laid on stone blocks of five cubic feet, for the first year, per mile	£150 0 0	
Ditto ditto second year . . .	80 0 0	
	£230 0 0	
Ditto, on larch sleepers, for the first year, per mile	£200 0 0	
Ditto ditto second year	120 0 0	
		£320 0 0

We shall now proceed to a description of the improved metallic wheel with wood-faced tyre, showing its advantages in connexion with the preceding observations. The construction of the wheel may be undarstood by imagining a spoked wheel with a deep channelled tyre. The wheel may be made either of cast or wrought iron, it having been ascertained that tyre bars can be rolled to the required pattern. In this channelled tyre are inserted blocks of African oak, measuring about four inches by three and a half inches, solidified by filling the pores with unctuous preparations; thereby counteracting the effects of wet by capillary attraction,—to which, by this means, it becomes impervious, and at the same time is not liable to unequal contraction and expansion. The blocks of wood are cut to the requisite form to fit very exactly in the external circular channel of the wheel, with the grain placed vertically throughout, forming a complete facing of wood, as shown in the engraving. There are about from twenty-eight to thirty of these blocks round each wheel, where they are retained in their place by one or two bolts passing through each, the two sides of the channel having corresponding holes drilled through them for this purpose: the bolts are then well rivetted. After being so fitted, the wheel is turned in the usual manner. The wheel when finished has all the appearance of a common railway wheel, but with a rather deeper rim, the tyre faced with wood, and the flange of iron. Woods of various qualities may be used, whether hard or soft, requiring different chemical preparations according to their porosity, and in some instances requiring to be compressed.

The several advantages which this wheel possesses, are—

1. That the wood facing will wear a considerable time without requiring any repair.

2. That the wood can be refaced, by turning it up again in the lathe, as practised with worn iron tyres.

3. That the tyre can be re-faced with wood at little expense, and at a far less loss of time than usual. In the operations of re-facing these wheels, or putting in new wood, the work can be performed without the labour and cost of removing the wheels from the axles, which in the keying and unkeying is known to be very troublesome.*

4. That, in regard to their working, it is the opinion of practical engineers, confirmed by actual experiment, that they will work smoother, easier, and, as some have expressed it, more "sweetly" than iron-tyred wheels; with the advantage of going well in wet weather, even upon inclines,—having sufficient adhesion to the rail, without dropping sand to assist them in this respect, as practised when iron wheels are used.

5. That another and very important result will be, that the rails themselves will suffer less wear by using this kind of wheel, and that the fastenings, sleepers, and blocks will receive considerably less injury, and thereby favour the laying of railroads on stone blocks, whereever they are considered to be most desirable.†

A metallic wheel with a wood-faced tyre, which is the principle of this construction, obviates most, if not all, the difficulties which have been experienced, whether in the use of wooden, cast iron, or even wrought iron wheels. Cast iron wheels may, indeed, now be considered not far short of being equal to wrought iron wheels, for safety and durability, with all the superiority of which the application is susceptible. They are also neither clumsy nor inelegant in form, and are capable of being made to any pattern, even for carriage wheels for common roads. It may, therefore, very possibly occur that they will have the effect to bring cast iron wheels into as general use, and as much reputation here as on the continent. This new construction and simple adoption of wood makes excellent driving wheels for locomotives; it may be readily stopped by using a cast iron break, and does not undergo that wear which might be expected from the friction it then has on the rail. The wood, by use, becomes exceedingly close and firm, acquiring a surface not easily distinguishable from metal in appearance.

These wheels are manufactured by Messrs. Brocklehurst, Dircks, and Nelson, millwrights, engineers, and iron-founders, at their works, No. 12, Oil Street, Liverpool; where they may at any time be seen.

CANDIDUS'S NOTE-BOOK.

FASCICULUS XX.

> "I must have liberty
> Withal, as large a charter as the winds,
> To blow on whom I please."

I. After "*But*," the most provoking word in the language is your "Only"; which is employed extenuatingly to apologize away, as it were, the very sum of complaint, as being a mere trifle, too insignificant to be taken into the general account. This or that building may have *only* such or such defect, and of course you run the risk of being set down for a very ill-natured, or an exceedingly fastidious hypercritical sort of person, if you object to it on such account, even though it should be of such nature as absolutely to cancel all other merits and recommendations. There are cases in which a single defect may be a fatal one; I might instance this directly and architecturally by referring to buildings which furnish cases in point; but it may be illustrated by the anecdote related somewhere, if I mistake not, by Theodore Hook, of the Adonis who had only a single blemish. In every other respect his person and countenance were unexceptionable. His mouth, teeth, hair, eyes, hands, were all allowed to be perfect, and were expatiated upon by a friend so eloquently that a lady fell in love with his description, and desired that the original might be introduced to her; on which the other thought fit to hint that he had omitted one slight imperfection in the portrait he had drawn, but it was "only a single blemish," a mere trifle, absolutely, in comparison with the loss of an arm or a leg. "Oh! some scar, I suppose—perhaps a wart?" inquired the lady; "an unlucky wart, perhaps, on the tip of his nose." "A wart on tip of his nose! Bless your heart, no! for the truth is, he has—*no nose at all!* which little defect is the one I alluded to."

II. It is precisely such "little defects" and slight blemishes that mar so many buildings and works of architecture. They have—in description at least—a host of merits; columns *comme il faut*, Doric or Corinthian, unexceptionable proportions, amplitude of dimensions, solidity of materials, &c., are expatiated upon till you raise your expectations almost to the highest pitch. At length you discover that the "slight defect"—the "only fault"—should any have been hinted at, renders the anticipated piece of perfection very much in the same plight as the Adonis with the single blemish—the Adonis without a nose.

III. When people begin to be sick of the everlasting boring and twaddling about styles, they will then, perhaps, begin to find out that quite as much or more depends upon the application of a style, as upon its merits as such. For what are the different styles of architecture, but so many different languages of the art—some of them more perfect, more expressive than others; but the excellence of a language, and the excellence of a composition in it, are quite distinct matters. The same language may be the vehicle of wit or of stupidity; and so also may the same style of architecture be employed tastefully or uncouthly; by one so as to charm and delight, by another so as to excite only ridicule and disgust. Which being the case, of what practical value are all those superficial, vague, and wearisome discussions from time to time on the subject of styles, in which not a single idea is brought forward that has not been repeated times innumerable before? On no other subject would such mere school-boy stuff be endured, much less pass for any show of learning, as is *parroted* in regard to architecture. Many prate most glibly about the age of Pericles; yet ask one of those erudite, sagacious gentlemen, what he thinks of that age in its chryseo-elephantine works, and architectural polychromy, and ten to one but he will be struck all of a heap; he wonders what *elephants* have to do with the matter, nor did he know before that Pericles had a daughter named *Polly*.

IV. The fact is, we are apt to judge of styles as we do of national or of professional character—in the lump; which, though a most expeditious and convenient, save-trouble mode, not unfrequently leads into dreadful blunders. The French are a lively people, yet shall you find Frenchmen of most excessive dulness and stupidity. You may stumble upon honesty in the shape of a lawyer, on temperance in that of an alderman, and on perfect good-nature in the person of a sarcastic satirist.

---

* As in every thing affecting railways, it is a desideratum to decrease the expense as much as possible, it may here be mentioned that three feet cast iron wheels, with wood-faced tyres and wrought iron axles complete, can be made much cheaper than the generality of wheels.

† On lines situated like the Greenwich Railway and the Blackwall Railway, wood faced wheels would diminish much of the noise which at present is a source of general complaint.

V. In an article in the Gardener's Magazine for November occurs the following bit of architectural comment: "in returning we observed two frightful chapels; the Hanover Chapel at Peckham, in the form of a pentagon, with small mean windows without facings, and red brick walls without cornices or any decoration whatever: and another chapel nearer Camberwell, of larger size, with similar walls. and *three or four stories* of naked windows like those of a third-rate dwelling-house! Chapels in general, throughout the country, are at present *a disgrace* to it, in an architectural point of view; but it is to be hoped that the spread of knowledge and taste will raise them to a par with other religious buildings." Yes, our chapels—and *churches*, too—generally are a disgrace to the country, as well on account of the beggarly, shabby, sordid meanness, as for the execrably bad taste they display. But as for the good taste that is to lead to a better system of things, where is it to come from? Certainly not from the fountain head—not from the Church Commissioners. However, I will not be quite sure that even brick boxes, with three or four stories of sash windows, are not a degree more endurable than those most trumpery *Gothicisings* or *Grecianizings*, as the case may be, which spring up like mushrooms in the purlieus of Islington, &c., and whose scanty pauper finery forms a contrast no less ludicrous than woful, with the bareness of their posterior parts. Economy is excellent, but the economy which treats itself with a smart shirt front, while it denies itself a pair of breeches, cannot possibly be extolled for its nice attention to decency.

VI. If I am rightly informed, more than one of the Islingtonian buildings alluded to is the joint production of two architects, in which case, to judge from the littleness of their united taste, the taste of each singly must be exceedingly little indeed. Or, would not the rather stale anecdote of the two helpmates come in here most pat? "What are you doing, Jack?" "Nothing, sir." "And Tom, what are you doing there?" "Please, sir, I'm just helping Jack." It was undoubtedly after some such fashion that the Messrs. Tom and Jack there employed *assisted* each other in providing taste for the Islingtonians. Certain it is that taste fares no better among Church Commissioners than among their worships the Churchwardens.

ON THE ORIGIN OF ALPHABETIC WRITING ON MONUMENTS, TOMBS, &c., IN ANCIENT GREECE.

AMONGST the many pleasures connected with historic research, may be recorded that which the antiquary feels, as the evidences of some lost truth unfold themselves to his eye. To find how link after link completes the chain, or how the past is restored to observation after a lapse of centuries, is no less interesting, however, to the architect, the painter, and the sculptor, whenever the purposes of art are assisted by such a discovery. With this preface of apology for discussing the present subject, I humbly offer my opinions, with the unpretending wish only, that it may lead to a deeper attention from others. My idea of handling the theme arose from a remark of Canina's upon some ancient tombs found at Cœre, (now Cervetri, or Ceveteri). His remark is embodied in a paper, read at the Institute on the 30th March, 1840. He concludes from the peculiar form of the Greek characters of the inscriptions, that the tomb must have been erected before the Trojan war. Now the Trojan war is an event—an epoch in history. It encompasses within it a variety of interesting facts, customs, manners and rites. To determine the existence of alphabetic writing, as existing on monuments and tombs, before or after that period, is no less interesting; especially as in the investigation we trample on the memory of the honoured dead; for whom art has done and expected so much, and for whose deeds and memorable acts, genius has prepared such monuments of beauty and of skill.

Canina evidently presumes alphabetic writing as common to the tombs of the great before the Trojan war. With submission then to his opinion, as well as to others, who I know agree with him, I will assume the contrary, and endeavour to prove it of a later period.

First, I rely greatly on the authority of Homer, on the minuteness, care, and correctness of that poet, on his punctilious observance of customs, and on the extreme finish of his descriptions. Assuming this, I turn to the tale of Βελλεροφον (Iliad 6th, 168), not to disprove the non-existence of letters, &c., but to reveal Wolfius a German commentator upon Homer, guilty of the same idea as myself, since upon that tale, he presumes alphabetic writing unknown in the heroic ages. Secondly, our introduction to Patroclus's tomb, has no mention of any inscription, or written memorial. Thirdly, that the word γραφειν of such frequent occurrence, according to Guoquet, "ne signifie jamais chez Homer que representer oû decrire un objet." Fourthly, that wherever commands are given, or messages sent, they are done verbally; and whenever a treaty is ratified, it is done by sacrifice, or oath. Then again, Virgil's careful picture of Misenus's death and burial, and of the tomb erected, &c., mentions no inscription, which strengthens the argument, when we consider that Enœas is trying to pacify the spirit of that hero in the infernal regions, with a minute detail of all the honours and tributes paid to his memory. To omit one observance, would display a carelessness totally at variance with an otherwise ingenious recital.

Besides no nation was ever more jealous than the Greeks of funeral honours. The advantages of an illustrious victory were often neglected to perform this duty. Victorious generals were sacrified for want of zeal in burying the soldiers slain in battle; whilst the auguries they derived from, and the vows they made over tombs, evince with what earnestness, the depositaries of the precepts of religion, had ever recommended the duties of the sepulchre. But perhaps it may be said that Guoquet in his work "sur les origines des lois, des sciences et des arts," admits the existence of alphabetic writing in Greece before the Trojan war. If so, let it be remembered, he adds, "that it was less practised." Besides if Guoquet were correct in his supposition, the knowledge of letters as a medium of conveying thoughts through the body of the people, must necessarily prove tardy and progressive. And although we believe it in existence at the time of Cadmus, still a natural inference would be, that the priests, as in ancient Egypt, were for a long time alone familiar with the written or descriptive language. The fact, too, that the Mexicans and Peruvians had attained to a great degree of civilization, without the use of letters, may assist such an idea.

The question then naturally arises, how, if inscriptions be to memoralize worth, or to record virtue, and how, if the knowledge of letters be assumed as slight, partial and confined, could the object be effected; or why would the artist chisel out in letters, the deeds of the departed, when most of the passers by were unable to interpret. Upon these grounds I humbly dispute the remark of Canina's: and I do so, not for the bare love of agitating subjects, which but for the curious and ingenious, would be contentedly dismissed, as unworthy and trivial; but from an anxiety to arouse the slumbering energies of the artist, and to invite a cool and rational enquiry into the antiquities, literature and minutive of his art.

FREDERICK EAST.

November, 1840.

DESCRIPTION OF THE HYPSOMETER.

An Instrument invented by JOHN SANG, *Esq., Land Surveyor, for taking the Heights of Trees, Buildings, and other objects. Communicated by* MR. SANG, *Land Surveyor, Kirkcaldy.*

(From the Gardeners' Magazine.)

I have taken the first leisure hour to make you the instrument for measuring the height of trees and buildings which I mentioned to you when having the pleasure of visiting you at Bayswater. It is sent by post at the same time as this letter.

The instrument was tried on some houses and trees here, and it gave their height (especially the houses) with great accuracy. It is rather difficult to manage at first, but after a few trials it becomes quite easy. The method is as follows:—

By means of a small hook (if a knot of white cloth be attached to it, so much the better), fix the end of a tape line to the bole of the tree, at exactly the height of the observer's eye from the ground. Retire from the tree, letting the tape line unwind until, by using the instrument, the top of the tree and the end of the tape line are seen quite close together. Add the height of the observer's eye to the length of the tape line, and the sum is the height of the tree. Now, the difficulty is, to catch the image of the top of the tree in the instrument, and it is this which requires a few trials, although any person who has been accustomed to use a sextant will do it at the very first. Hold the instrument at one of the milled ends, taking care that the fingers do not project over any of the holes, and that the brim of the hat is out of the way. Apply the eye to the round hole marked a in fig. 1, and look through in the direction of the small square hole b, the instrument being held so that the line joining $a\,b$ is about level, while the large square hole c is turned towards the sky. You will then see some object directly through the small hole, and at the same time the image of some other object, the light from which enters the large aperture, and, after being reflected by the two mirrors inside, passes into the eye. Whatever two objects are thus seen in contact, subtend at the eye an angle of 45°, as in fig. 2; so that, if one of them be the end of the tape line on a level, or nearly so, with the observer's eye, while the other is the top of a tree, supposed to be growing straight up, the distance from the eye to the bole of the tree will be exactly equal to the distance from the end of the tape line to the top of the tree.

Fig. 1.

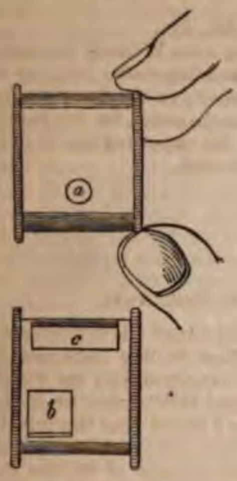


Fig. 2.

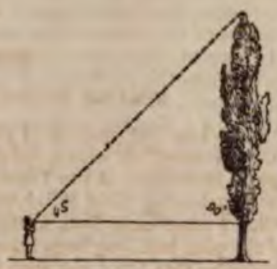


Fig. 3.

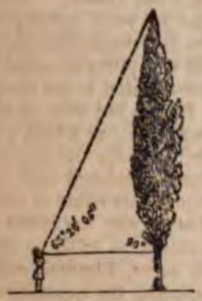
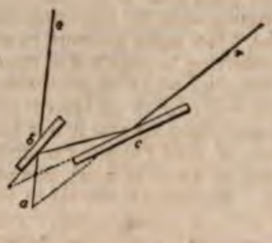


Fig. 4.



You will thus observe that the accuracy of the measurement depends on the tree being erect from the ground. On sloping ground the measurer would require to go out from the tree in such a direction that the tape line was perpendicular to the stem, but this could be judged sufficiently well by the eye to give the height, of even a very high tree, nearly correctly. The heights of those houses I tried were given within an inch, which was no doubt owing to their being perfectly upright on a level court yard.

The principle of the instrument is quite simple, being exactly the same as that of the sextant or quadrant, only that the mirrors are fixed at a certain angle instead of being movable. Thus, in fig. 3, *a* is the eye, *b* a mirror partly silvered, and *c* a larger mirror wholly silvered. A ray of light *r*, falling on the mirror *c*, is reflected from it in the direction *c b*, and again reflected from the mirror *b* in the direction *b a* to the eye; at the same time another ray of light comes from an object *o* direct to the eye at *a*, without being reflected. From the nature of reflected light, the angle *r a o* is equal to twice the inclination of the mirrors, and is constant, however much the whole instrument may be moved in the plane of the objects, as you will easily perceive by catching the reflection of the candle in the instrument, and moving it in the plane of the milled ends.

I am sure this very portable instrument will be useful for measuring single trees, or buildings, which are as far asunder as they are high, but I am afraid it will not work well in a close wood, on account of the operator not having room to retire as far from the trees as their height. If this is found to be the case, the remedy is to construct another instrument in which the mirrors are placed so as to give an angle of 63° 26′ 05″. In this case the height of the trees will be equal to twice the length of the tape, added to the height of the observer's eye. (See fig. 4.) Of course a small deviation from squareness in the trees and tape line will make a greater error than with the instrument sent, bnt still it will give a result near enough for all practical purposes.

I have only to add, that the mirrors are made of common window glass selected as the most even from among a great many pieces, but still they are not quite flat. I had some glass from London perfectly true and flat, but so dim and badly polished as to be unfit for use.

Kirkcaldy, Jan. 31, 1840.

Postscript in Answer to some Questions asked of Mr. Sang by the Conductor.

The instrument for measuring the height of trees is not a pocket sextant, like that of Mr. Blackadder, mentioned in vol. xiv. p. 257, although nearly allied to it. The sextant, quadrant, reflecting circle, improved Wollaston's goniometer, as well as the optical square and tree-measurer, are all varieties or improvements on Hadley's first invention. The two latter differ from the rest in the mirrors being permanently fixed at angles suitable for the purposes for which they were intended. The pocket sextant would measure the height of trees quite as well, but, being expensive, and requiring some skill to use it, it is not likely to be much employed for such purposes. There is no sort of merit in designing the instrument; and is so exceedingly simple, that I have no doubt the idea of modifying the sextant, so as to make it readily measure the height of trees, has occurred to many a one. I, however, never heard of such an instrument, and believe that the one you have is the second of its kind in existence. The other is one which was made for yourself. My father was so much pleased with it that he asked me to make one for him, which turned out neater than the first, and accordingly I sent it to you, as being the better of the two. As there is nothing like a Greek name for giving identity to it, you might call it a dendrometer, or, better still, a hypsometer (measure of height).

Of course any instrument maker could supply these articles; the price, I should think, would be about 20*s*. each. If there were any prospect of selling a dozen or two, I could easily employ a workman here to make them, and they might be sent from the seedshop to any place by post.

Kirkcaldy, Feb. 18, 1840.

BRITISH MUSEUM.

Sir—That the British Musenm is a *monument*—as the French term it, which does honour to this age and country, is what, for peace sake, I will take for granted, notwithstanding that I myself perceive nothing particularly monumental or dignified in the sulky and barrack-like aspect of the exterior of the new buildings. No one, indeed, can deny that the most frugal economy has been observed there—of course a very plain proof with what rigorous conscientiousness the cash is uniformly doled out of John Bull's public purse. Still there are illnatured grumblers who opine there are occasions when liberality bespeaks more prudence than cheese-paring economy, and is the more becoming virtue of the two; and that such an edifice as the one I am speaking of, ought to be in every respect a finished piece of architecture. Possibly, the façade—whenever that comes to be executed—may make some amends; yet it surely would have been better that the whole should be of a piece, and not like Dick Wilson's fine embroidered waistcoat, with its 'back-front' made out of one of his own picture-canvasses. It may be very true that the rest of the building is not intended to be seen, but still as it is not screened from view, it is rather hard to tax the imagination of matter-of-fact folks like myself, so far as to tell us we are to imagine we do not see what is staring us in the face, nor to give credit to our own eyesight. Upon such notable principle of economy, the backs—I mean the East end of St. Paul's, might have been left a plain brick wall; but it seems Sir Christopher's notions of economy were very different indeed from those of Sir Robert.

I find I have rather committed myself, for what I have been saying is likely to call the sincerity of my first sentence, terribly into question. No matter; it can't now be helped; and only proves that liars and critics ought to have good memories. Accordingly my willingness to 'take for granted' and so forth, must now either be set down as a palpable *hum*, or be imputed to my considerate forbearance in not discussing the architectural merits and demerits of Sir R. Smirke's edifice. I will not inquire whether the taste he has shown in the interior of the building is such as to indemnify us for its excessive homeliness without; nor whether he has been prodigal or economical in drawing upon his fancy and imagination. But I will say that however much he may have consulted convenience rather than splendour, or may have succeeded in combining both, in other parts of the plan, he has attended to neither the one nor the other in the Reading Rooms, which are about as inconvenient for the purpose as could well have been devised,—to such a degree that without taxing our fancy very much, we might fancy no instructions respecting them had been given to the architect, and that when it was afterwards discovered that the Book-makers and Novel-readers who frequent the British Museum, must be put somewhere, they were *accommodated* where they are now crammed. "Remuneration means five farthings," and in the present case accommodation means being left to shift as well as you can for yourself, and perhaps be forced to sit in dim-twilight—where if you cannot see to read, you may at least sit and muse,—which of course looks solemn and meditative, and is highly becoming in a *Muse*-um.

This is no exaggeration of mine, since it is hardly possible—except, indeed, for literary *owls*—to see to read at any of the tables on the window-side of the West room, in dull weather; those windows being at a considerable height from the floor, and there being no others at either end. Consequently one-half of it is so imperfectly lighted, that were it a church people would grumble at it as a dismal dark hole, where they could not see either to hear the sermon, or to study the newest fashions of the congregation. There may indeed be some who can see to read by their own inward light; but the generality of people will perhaps agree with me that apartments not intended merely as libraries, but as *public* reading-rooms, where instead of seating themselves just where they can see best, people must be content with the best vacant places they can find,—that such apartments should be sufficiently and uniformly lighted, so that every part should be equally commodious in that respect.

It would have been infinitely better to have had for the purpose, rooms less lofty, and lighted entirely from above, with a clerestory lantern along the centre, and skylight compartments along the sides, so as to diffuse the light as equally as possible every where. But, it will be said, it was quite out of the architect's power to do this, there being an upper floor: yet it was surely then matter for consideration whether it would not be more eligible to convert the present rooms to some other purpose, and make use of one of the upper galleries (lighted from above) as Reading-rooms. The extra trouble of having to ascend higher in order to reach them, would be amply compensated by their greater comfort and commodiousness,—for their present length might then have been considerably extended. Perhaps it will be objected—for *buts* and objections are always plentiful enough—that this would have been attended with one serious inconvenience,—namely, the distance from which books would have to be fetched were the Reading-rooms not upon the same floor as the Libraries. Yet that difficulty would be at once obviated by having a *lift* or shaft (as many as might be requisite), close by the bar where the books are delivered; and by means of which a whole cargo—if requisite, might be raised equally expeditiously and easily.

There are, however, other inconveniences in the present rooms that ought to be remedied. One is that the space is by much too confined, for either the tables ought to be nearly double their present width, or there ought to be seats only on one side, for when a person has—which is frequently the case—very large folios before him, they occasion inconvenience both to his opposite neighbour and himself: besides which sufficient space is not allowed between one sitter and another, should they both happen to have many books or very large ones by them.

Were it not that it might be deemed a piece of shameful extravagance, I would hint that it would not be omiss if a few yards of drugget or matting were purchased to lay down along the centre avenue of the Reading-rooms, in order to deaden the noise of persons perpetually passing to and fro on the stone pavement there. By way of providing the ways and means for raising the sum required for buying the said drugget, I would recommend that the open wire-work doors now enclosing the bookcases in those rooms should be taken off their hinges and sold; because so far from being of any use, they are merely a very great nuisance. Being unglazed they do not protect the books from dust, neither are they any protection whatever against plundering—if such be their intended purpose, because those cases—which contain books of reference, journals, dictionaries, &c., are accessible to any one, as he may have as many as he pleases opened in turn, if he summons the turnkey attendant, and as when once opened the cases are left unlocked, there are always several from which persons can take down books. There are, besides, always piles of books on the tables, from which a person frequenting the Museum for such a purpose, might filch away any pocketable volume, though even then he could not pawn it without first mutilating it, by tearing out the Museum stamp-mark. Therefore in the way of precaution against filching books, the doors to the cases in the Reading-rooms are quite nugatory—a mere idle show of carefulness and security. In themselves, however, they are a nuisance, not only as imposing needless trouble and bustling about, to both attendants and visitors; but because they are actually in the way when opened, while persons are referring to the books, there being then no room for other people to pass between them and the tables. If, therefore, there must be doors to those bookcases, the tables ought to be shortened two feet, so as to allow greater space between the ends of the tables and the walls. I will not now speak of the Catalogues except to say that I believe they are blessed undevoutly backwards, every day and all day long. Neither will I now touch upon the literary wealth of the Museum in those departments which are most likely to interest your own readers, it being utterly impossible to do justice to either topic at the fag end of my present letter; I must, therefore, reserve them for another. That some improvements have taken place of late years I do not deny, but still the Museum requires a good deal of poking up, before it will be placed upon the footing which it ought to be.

I remain, &c., &c., &c.,

JOHN [but not John Wilson] CROKER.

P.S. I forgot to remark that had the Reading-rooms been on the floor above that where they now are, namely, on the first floor from the sky, they would have been much more in character, for the votaries of literature have always greatly affected the upper regions of buildings—vulgarly termed garrets—for their abodes.

SURVEYING.

REMARKS ON THE NEW SCALING INSTUMENT.

SIR—The last number of your Journal contained a letter from "An Old Surveyor," in which, speaking of the New Scaling Instrument recently introduced at the Tithe Office, and extracted from my *Treatise on Engineering Field Work*, into your Journal for October, he remarks "that I must have been misinformed when I stated that the principle of the plan had long been known to some few surveyors, &c., and also believing that I did not wish to deprive the inventor of his due share of credit, to state who were the parties acquainted with the principle of the plan, prior to its introduction at the Tithe Office." From the courteous—not to say complimentary tone of your correspondent's letter, I feel much pleasure in affording him the requisite information. By referring to page 353 of your Journal, he will perceive what I mean by the *principle of the plan*, which was communicated to me about three years since by an esteemed professional friend, but who at the time did not inform me that it was his own conception; and which I was not aware of until I applied to him, since reading "An Old Surveyor's" letter, to know in what manner he became acquainted with the process. Subjoined is the reply, but at his request his name is withheld; but for your correspondent's satisfaction, I send you the letter to take the requisite particulars from. In the autumn of 1837, he observes, "being engaged upon a survey of 12,000 acres, I looked with some degree of concern at the drudgery of computing the quantities. Mr. B. had previously explained to me his mode of ruling parallel lines across the several enclosures, but this method I thought would be troublesome, and be attended with the risk of injuring the maps. The idea then occurred to me of using a thin piece of horn ruled with lines one chain apart. In the interval that elapsed between my sending for, and receiving the horn, I made of tracing paper the machine I described to you, and find it to answer my purpose, used it to the end of my survey in the spring of 1838, since which time it has not seen the light, but is no doubt amongst my old papers."

I think the above particulars must be satisfactory to your correspondent, at least I hope so; and now perhaps I may be excused asking him, who the inventor of the modified instrument at present in use at the Tithe Office, is? for certainly there is great credit due to him, and which I indeed stated in my work, when I called it an "ingenious application of the above system." If an Old Surveyor will favour me with this particular, I shall have much pleasure in mentioning it in the second part of my work shortly to be published.

I remain, Sir, your's very obediently,

PETER BRUEF.

Charlotte Street, Bloomsbury, Nov. 16, 1840.

SIR—An "Old Surveyor" in your last number doubts the remark made by Mr. Bruff, that the *principle* of the New Scaling Instrument had long been in use by some few surveyors.—In reply I beg to observe that I have known many surveyors of the old school who worked on this principle, by means of a long scale and pricker, taking the amount of the chain widths and transferring them into acres, roods and perches by the decimal table; the new instrument has certainly much improved the system, and having the parallel lines on glass paper is a further improvement. The old system was a very defective one, and repudiated by all really practical men. As to the new instrument, after using it in my office for many months, and in various large surveys—I find it unsatisfactory, it is after all (notwithstanding its high recommendation) best adapted for the schoolboy and the tyro.

I am not surprised at its general adoption, for the former approved system of equalizing into trapeziums and triangles is very laborious work, if pursued for a length of time successively, but after giving both a fair trial, I must say I find the old system the most expeditious and certainly the most satisfactory. One feels no satisfaction with the instrument without repeating the operation, in repeating, the results will not always be the same, a third or even a fourth operation will frequently be required, each time requiring the whole to be done over again; whereas by allowing two young hands to figure for each scaler, they check one another, and repeating the operation from opposite points, prevents any serious errors by using proper precautions.

Perhaps I have a little feeling with yourselves against "ready reckoners," but I have experience on my side, and I have laid the *instrument* on the shelf.

It is a pity to see practical men recommending such games of marbles as your Dublin correspondent, if he would work with *eleven* arrows and make *frequent* use of his pen, he would bequeath his marbles to his children. Every *surveyor* should follow his own chain in long lines, and stopping to book his changes, stations, crossings, &c., will find him plenty to do, without carrying a marble bag.

The number of mushroom surveyors whom the pressure of business have hatched into life, has detracted much from the respectability of the profession, the public however are beginning to find out, that old and tried hands are most to be depended on; an engineer too may be a good surveyor in theory, but he will never come up in the field to an old fashioned surveyor. I do not know any thing that would give me greater pleasure than to give a certain eminent gentleman in that line, (well known to our profession, for his upright, impartial, and gentlemanly demeanour), one week's *practical surveying*, he would find there was but little "Sham Abraham" in it.

I shall conclude these few remarks by again assuming a name under which I have before entered your columns,

As your very obedient servant,
"Surveyor."

Ashford, Nov. 14, 1840.

ON REMOVAL OF EARTH-WORK FOR EMBANKMENTS.

Sir—In your Number 38, for November 1840, at page 392, you state that "up to April 1837, not even 200,000 cube yards had been teamed to embankment on one face, in one year."

Between Nov. 2, 1839 and Oct. 17, 1840, there were tipped, according to my official returns, on the Birmingham and Gloucester Railway, on one face of embankment, across the valley of the river Rea, near Birmingham, 293,246 cube yards; the mean lead being 1¾ miles, and the extreme height of embankment 62 feet from the meadows. I believe that a ratio of progress fully equal to the above, was maintained not far from Gloucester on the same railway, for a few months in the Autumn of 1839; but as the work was then in the hands of the Cheltenham and Great Western Company, I cannot give you farther particulars. I am under the belief that other engineers could supply you with information as to larger quantities than the above being tipped in the same space of time.

I am, your's faithfully,
W. S. Moorsom, *Engineer.*

[Communications similar to the above are of great importance to the profession; we hope other engineers will follow Mr. Moorsom's example, and favour us with the result of their observations.—Ed.]

THE NAPOLEON MONUMENT.

Mr. Editor—Having in the September number of your highly interesting periodical, perused an article under this head, and feeling a deep interest in the subject, I take the liberty of sending you my own opinion; though, whether it is likely to effect any good, or is worthy of insertion in your Journal, your able judgment will best decide.—During a recent visit to Paris, I was particularly struck by the exhibition (mentioned in the above number) of a full size model of the intended testimonial to the Emperor in the Dôme des Invalides, as not being altogether consistent with that good taste so frequently displayed in the French capital. To every one who has seen the effect of the Baldachino in St. Peter's, at Rome, which is universally acknowledged a complete eye-sore, this striking similarity of arrangement must evidently tend to give the same result. The magnificent Dôme, being itself such a tastefully decorated room, can, according to my ideas, by no means suffer any erection, like this complicated, by an equestrian statue crowned monument, to dispute its grand simplicity. A colossal statue of the hero, say from 18 to 24 feet high, *cast in white metal and frosted,* erected on a circular pedestal of Egyptian porphyry, in the centre of the large Mosaic star, would methinks produce a different effect. The sublime grandeur of the Egyptian colossi, all rude and mutilated as they are, speak for themselves, and in behalf of my opinion. They likewise convince me that supernatural size would here especially answer the purpose. I suggested my idea on the spot to a friend present, and have since found no reason to make any alteration.

Your's most respectfully,
C. Tottie.

14, *University Street, Nov.* 9, 1840.

COMPETITION DESIGNS.

K. P. S. in reply to Mr. Sparke.

Sir—It gives me much pleasure to see in your number for the present month, that you have other correspondents who interest themselves in the subject of competition, and it is with especial satisfaction that I have read the answer of Mr. Sparke, to my letter on the subject of the Bury affair, since it leaves every essential fact in my statement unshaken, except one. Nobody can be imposed upon for one moment by the mist of words in which the Hon. Sec. flatters himself he has enveloped the truth.

It seems I have been misinformed as to the amount of the contract, which is £3,353 instead of £3,550. What then? Does the amount affect the moral principle?

There certainly are cases which differ from competitions, inasmuch as the law is apt to take cognizance of them, in which the proper name by which the transaction is called, varies according to the pecuniary amount involved in it, but as we cannot suppose the Hon. Sec. to the subscribers means to insinuate any analogy, we must conclude that he argues like the damsel who excused her peccadillo because it was "*a very little one.*"

As to the conundrum about the duties, it is too shallow to be respectable. The contract is £3,353,—there is £230 to be laid out in foundations, which it was evident must be laid out to all but those determined not to see, and then there is the painting and plastering. £350, supposing it to be so much, will not cover an excess of upwards of £600.

Though quite unnecessary for the argument, I will beg your readers to peruse the clause referred to by Mr. Sparke relative to the duties. Will any one undertake to say whether it is intended to mean that the duties are or are not to be considered in the estimate. It is most ingenious, and well calculated to maintain a quibble upon. Where the meaning is obscure, we must enlighten it by the context. "*If the subscribers shall be unable to find a respectable builder willing to execute the design of any architect for the sum of* £3,000, *such architect shall have no claim of any kind upon the subscribers,*" &c. This at least is plain English, and I shall take the liberty to believe it can have but one meaning, even though it should be explained away as satisfactorily as Lord Peter proved his shoulder-knot to mean neither more nor less than a broomstick,* or as Mr. Sparke has explained away all the rest of my statement.

But one word more—I will not dispute whether the contrivers of this business were *called* a committee, but it is notorious to all Bury that it was managed by a *clique* who, according to Mr. Sparke's showing, turn out to have been as irresponsible as they were officious. I could name an occasion on which one of the leading members expressed himself in no measured terms, upon some symptoms of dissent from his authority, shown by other parties concerned.

Enough of this, and more than enough for any good it is likely to produce. I have said before, and say again, that reform must come from the profession, and to them I would recommend a very simple plan, by which it may be effected, viz., that every one should reform himself. In the mean time, Sir, accept another contribution to the *facts,* which I hope to see accumulated, until architects shall be ashamed to rake in the filthy puddle of competition at the command of every body and any body. For reasons which will instantly be appreciated, I omit all names.

It is now nearly two years since the following advertisement appeared in the public papers:—

"To Architects.—Any architect desirous of competing for the proposed enlargement of W—— church, must send in his plans, specifications, and estimates, free of all charge or expence, to the Secretary, the Rev. Mr. T——, Vicarage W——, on or before the 19th January, 1839. For farther information apply to the Secretary."

Application having been made for farther particulars, the following were furnished in reply:—

---

* See the Tale of a Tub.

"That the committee would require a plan of the different floors of the church, showing the present arrangements and proposed alterations, an elevation of each front affected by the proposed alterations, a longitudinal and transverse section showing the timbers of the roof, &c., together with a detailed specification of the works, and estimate of rendering the church, both inside and out, fit in every respect for public worship. An additional estimate of what would be the expence of repewing the present church on a better plan, in conformity with the proposed new addition. An estimate of the expence for an additional gallery.

"That the limited amount of the funds would not allow of any premiums being given for the plans.

"That the committee considered it indispensable for the competitors to inspect the church.

"That a commission of five per cent. on the sum expended would be allowed to the architect for his plans, &c., including the superintendance of the works."

And now, gentlemen of the profession, what do you suppose was to be the amount of this commission for the *chance* of which all this was to be done, and a journey to be made to W—— at the candidate's expence?

"That the Secretary informs the several architects that the sum to be expended will *not exceed four hundred and fifty pounds!!!*" I write it at length that no one may suppose a figure has been dropped.

The following letter, part of the correspondence, is too curious not to be given entire. The *naïve* impudence of the latter part will not easily be surpassed:—

"*W——, January* 5, 1839.

"SIR—In answer to your's of this morning, I beg to state that the committee desire me to say that they consider a personal inspection of the church necessary. Should you consider this worth your while, I shall be happy to give you any information in my power on the subject. I should state that the length of the church is 60 feet by 16 feet 10 inches, so that the work will be on a small scale. The amount to be expended will not exceed £450. *The Rector of the parish is an Architect, but has not informed me whether he intends to compete for the work.*

"I am, Sir, your obedient servant,

"H—— S——."

Begging every architect who values the respectability of his profession to lend his aid in exposing these scandalous practices.

I remain, Sir, your obedient servant,

K. P. S.

Nov. 13, 1840.

ATMOSPHERIC RAILWAY.

IN our last monthly number we published a letter received from Mr. Pinkus, commenting on an article in our July number on the atmospheric railway, in which he complains that great injustice had been done him, by giving credit to Mr. Medhurst "for having originated the idea of employing the power of the atmosphere against a vacuum created in an extended pipe laid between the rails, and communicating the power thus obtained to propel carriages moving on a road," and to Messrs. Clegg & Samuda "for having rendered this idea practicable and useful, by their simple and ingenious invention of constructing and closing a continuous valve, by hermetically sealing it up with a composition each time the train passes."

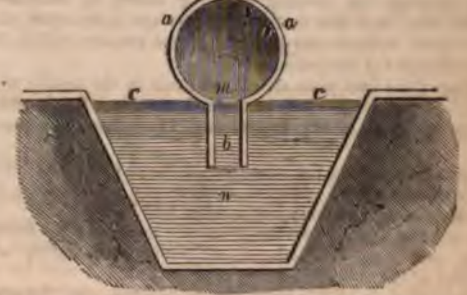
In treating on scientific inventions of interest, this Journal pursues the undeviating course of giving the fullest and clearest information, preserving the strictest impartiality as to the inventors; conferring praise where it is justly due, and pointing out error where we consider it to exist. Mr. Pinkus, after denying *in toto* all we have said of Medhurst and of himself, describes himself as "an humble labourer in the field of science," who would "never be guilty of that meanness of mind that would detract from another the merit justly due to him for any mental production." This principle we admire, and cannot but regret that he should have lost sight of it in the very next paragraph of his letter, where he attempts to deprive Medhurst of the praise we awarded him, by describing Papin as the author "of employing the power of the atmosphere against a vacuum." We are aware that this is due to Papin, but if Mr. Pinkus had not stopped short, but quoted our whole sentence, Medhurst must have come in for the praise we justly awarded him, viz. "of using the power of the atmosphere against a vacuum created in a pipe laid between the rails, and communicating the power thus obtained to propel carriages on roads,"—a very different thing from simply "using the power of the atmosphere against a vacuum," which we were fully aware originated with Papin, had been followed by Lewis in 1817, and Vallence in 1824. Returning, then, to the original idea of employing atmospheric pressure against a vacuum inside a pipe, and communicating that power to carriages moving on a road outside it"; we see nothing to alter our assertion that it is the invention of Medhurst, who published a detailed account of the means he employed, in 1837.* 2

Indeed, however reluctant Mr. Pinkus may be to admit this fact, the following extracts from Medhurst's pamphlet, places the matter beyond all doubt.

In page 15, this passage occurs—

> When the carriage is to go through the canal, from the engine, the air must be forced into the canal behind it; but, when it is to go the contrary way, the same engine is to draw the air out of the canal, and rarify the air before the carriage, that the atmospheric air may press into the canal behind the carriage, and drive it the contrary way.

In the following page 16, he says—

> It is practicable, upon the same principle, to form a tube so as to leave a continual communication between the inside and the outside of it, without suffering any part of the impelling air to escape; and, by this means, to impel a carriage along upon an iron road, in the open air, with equal velocity, and, in a great degree, possessing the same advantages as in passing withinside of the tube, with the additional satisfaction to passengers of being unconfined, and in view of the country.
>
> If a round iron tube, 24 inches in diameter, be made, with an opening of 2 inches wide in the circumference, and a flanch 6 or 8 inches deep on each side of the opening, it will leave a channel between the flanches, and an opening into the tube. If the flanches of this tube are immersed in water up to the circumference, as represented in fig. 1, where *a, a*, is a section of the tube; *b*, the channel; and *c, c*, the surface of the water.
>
> Fig. 1.
>
> 
>
>
> If such a tube is laid all along upon the ground, with the iron channel immersed in a channel of water, up to *m*, and a piston or box made to fit it loosely, and pass through it upon wheels or rollers, this box, driven through the tube by the air forced into it, may give motion to a carriage without, by a communication through the channel and the water.

Again in page 20, he describes

> A plan to combine the two modes together, that the goods may be conveyed within the canal, and a communication made from the inside to the outside of it, so that a carriage may be impelled in the open air, to carry passengers, would be an improvement desirable and practicable. It must be effected without the aid of water, that it may rise and fall as the land lies; and it must give a continual impulse to the outside carriage, without suffering the impelling air to escape.

And aware that his only difficulty was in constructing a means of confining the power in the tube by using a valve in lieu of the water joint, he remarks, that

> For this purpose, there must be some machinery which will diminish the simplicity, make it more expensive, and more liable to be disordered, unless executed in the most substantial and perfect manner; but, by skill, by experience, and sound workmanship, it may be accomplished in various ways, one of which I will describe, which, I presume, will evince the practicability of it.
>
> In order to make this in the best manner, the top of the canal should be made of wrought iron (or copper) plates, rivetted together, and rivetted all along, on one side, to a cast iron rail securely laid upon the top of one of the side walls; and made to shut down close, and air-tight, upon a cast iron rail laid firmly down upon the other side wall.
>
> In order to make the plate shut down air-tight upon the cast iron rail, without being rivetted to it, there should be a groove all along, upon the top and inner edge of the cast iron rail, and a thin edge of iron rivetted to the plates all along, to fall into the groove; then, if the groove is partially filled with some soft and yielding substance, as cork, wood, leather, hemp, &c., the thin iron edge will bed itself into it, and shut so close that the air will not escape, with so light a pressure as one pound per square inch.
>
> The plate that is to form the top of the canal, being thus prepared, may be

---

* This work was entitled "A New System of Inland Conveyance."

lifted up out of the groove two or three inches high, in any particular place of the side that is not rivetted; and, when let down again, the edge will fall into the groove, by the spring and weight of the plate, and stop close as before.

Therefore, if there is a large and light iron wheel fixed in the front of the interior carriage, and close to the side wall on which the plate shuts into the groove; and if this wheel is planted to stand two inches higher than the under side of the covering plate, this wheel, as it passes along, will constantly lift up the plates, and make an opening of two inches wide, or more, and 8 or 10 feet long; and, when the wheel has passed, the plate will fall down into the groove, and close the joint, as before.

Through this opening, a bar of iron may pass, that is fixed to the interior carriage, may project over the side wall, and the outer end may be attached to the exterior carriage by a chain or strap, and pull it along upon its own wheels and wheel track, which should lie along by the side of the wall of the canal.

The iron bar will not touch any thing as it passes through the opening, for the iron covering may be lifted up two or three inches high; but the bar need not be more than one inch in thickness.

In page 24, he says—

The same principle, and the same form, may be advantageously applied to convey goods and passengers in the open air, upon a common road, at the same rate of a mile in a minute, or sixty miles per hour; and without any obstruction, except, at times, contrary winds, which may retard its progress, and heavy snow, which may obstruct it.

If a square iron tube be formed, 2 feet on each side. 4 feet in area, with three sides, and one-half of the top, of cast iron, the other half of the top made of plate iron or copper, to lift up and shut down in a groove in the cast iron semi-top plate, as before described; and if a strong and light box or frame be made to run upon wheels, within the tube, and an iron arm made to pass out, through the opening made by lifting up the plate, as before described, this arm may give motion to a carriage in the open air. and upon the common road, without any rail-way, if the pressure within the tube is made strong enough for the purpose.

The opening of the iron plate should be made in the middle of the top, so that the iron arm may pass out, and stand upright a few inches above the top, to which the strap should be attached, to communicate motion to the carriage.

The frame or box, within the tube, should be 10 or 12 feet long, and must be guided by wheels, on all sides, as large as can be admitted, and as truly formed and planted as possible; the number will be 14 or 16.

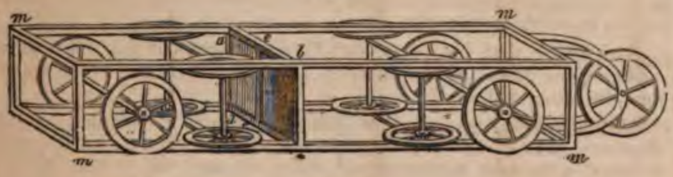
A piston, or vane, must be formed near the middle of the frame, to intercept the air, and must be leathered all round, so as lightly or barely to touch the sides of the tube.

The inside, or middle of this vane, should be open, and the opening filled up and closed by a valve, suspended by an axis across the middle of the opening, so that this valve, by turning on its axis, may open the vane, and suffer the air to pass through, and prevent its impulse upon the vane and carriage, or, by closing the valve, intercept the air, and give it motion.

By this means, the conductor of the carriage may restrain and limit the velocity, and stop the carriage, at any time and at any place, by a communication from the valve, through the opening, to the conductor on the outside; and this will be done without the least violence, shock, or chance of disordering any thing, either within or without.

Fig. 2 represents the vane within its frame *m*, *m*, *m*, *m*; the outside edge of the vaue, *a*, *b*, *c*, *d*, is leathered all round, and the middle part, *o*, *p*, *q*, *r*, is open, and is to be closed by the double valve, that is to turn upon its vertical axis *e*, *e*. The valve will shut, half on one side of the vane *a*, *b*, *c*, *d*, and half on the other; when it is shut, the air will be intercepted, and the impulse of the air will be given to the carriage; but, when the valve is turned a quarter of a circle, it presents its edge to the air, and leaves the interior of the vane open for the air to pass by unobstructed, when the carriage will gradually be stopped, by the friction of the road and the resistance of the outward air. It may be put in motion again, as soon and as gradually, by closing the valve.

Fig. 2.



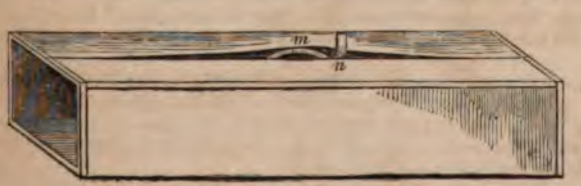


Fig. 4.

m, *m*, *m*, *m*, is the box, or open frame, that is to pass through the tube, on the wheels *n*, *n*, *n*, *n*, *n*, to support the vane, and the iron arm, and to be impelled by the air in the tube.

Fig. 3.

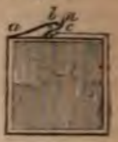


Fig. 3 is a section of the iron tube, with the wrought iron semi-top, *a*, *b*, rivetted to the flanch, and represented as lifted up by the projection of the wheel under it; and of the crooked iron arm *n*,as it is to come out through the opening, and stand up for the carriage to be attached to it.

The semi-top of cast-iron, *o*, *p*, is to be screwed upon the tube by the flanch *p*, and, at the edge *o*, is a small projection, which the edge of the wrought iron is to cover, to prevent the rain or dust from entering into the tube.

Fig. 4 represents a part of the tube, with the semi-top as lifted up at *m*, and the section of the crooked iron arm, *n*, as it is to pass out of the opening, besides the wheel that lifts it.

The iron tube should lie in the ground, with the top of it a few inches above the surface; and the carriage should run over it, with the wheels on each side; then the iron arm *n*, would draw the carriage in the fairest position.

The opening being, in this plan, made in the middle of the top of the tube, instead of the side, the lifting wheel will act either way, without being removed; but the iron arm that passes through the opening (to draw the carriage), as well as the arm that is to pass throngh (to open and shut the valve), must be changed to the other side, when the motion is changed to a contrary direction.

If the carriage is attached to the regulating arm that is to pass through the opening, and that arm is supported by the main bar. the effect will be, that, if by any accident the chain should let go its hold of the arm, the inside valve would instantly fly open; and the vane, being no longer impelled, would soon stop of itself, and the chain might be replaced.

In summing up this invention he remarks,

Although the perfection of this work is not to be obtained but by time, skill, experience, and the wealth of a nation, yet, upon a smaller scale, and less rapidity, the expense will be moderate, and within reach; and the value of it, compared with the present mode of conveyance, would be abundantly advantageous and desirable.

Here then is a clear and full explanation of a mechanical arrangement for employing the power of the atmosphere against a vacuum inside a tube, and communicating the power so obtained to carriages moving on a road on the outside.

No impartial person, and not even Mr. Pinkus can read these passages without being convinced that this most ingenious, though unfortunate inventor Medhurst, had brought the atmospheric system to the point where it was taken up by Messrs. Clegg and Samuda, and that his great practical failure was, that he could not, and did not make the valve air-tight, upon doing which the entire success of the system depended.

And now that we have shown what Medhurst did, and what he failed in, viz., "in making a continuous communication from the inside of the pipe to the carriage tight enough to allow a useful degree of rarifaction to be produced;" we will examine what progress the invention has made since then.

On the 3rd January, 1839, Clegg and Samuda obtained a patent "for a new improvement in valves and the combination of them with machinery." This valve, says the inventor, "works in a hinge of leather, (or other flexible material which is practically air-tight), similar to the valves commonly used in air-pumps. The extremity or edge of these valves is caused to fall into a trough containing a composition of beeswax and tallow, or beeswax and oil, or any substance or composition of substances which is solid at the temperature of the atmosphere, and becomes fluid when heated a few degress above it; after the valve is closed, and its extremity is laying in the trough, the tallow is heated sufficiently to seal up or cement together, the fracture round the edge or edges of the valve which the previous opening of it had caused, and the heat being removed the tallow again becomes hard and forms an air-tight joint or cement between the extremity of the valve and the trough. When it is requisite to open the valve, it is done by lifting it out of the tallow with or without the application of heat, and the before named process of sealing it or rendering it air-tight is repeated every time it is closed.

The inventor then goes on to describe how, by means of this valve in combination with a line of partially exhausted tubes, it may be rendered useful to move weights on railways. The combination employed being described precisely similar to that invented and published by Medhurst. The only claim set up in the patent being "the method of constructing and using valves as above described." The success of this valve has been demonstrated by six months experience on the Thames Junction Railway, and as the whole combination there employed, *except the valve and mode of sealing it*, is precisely that invent-

PLATE XVIII

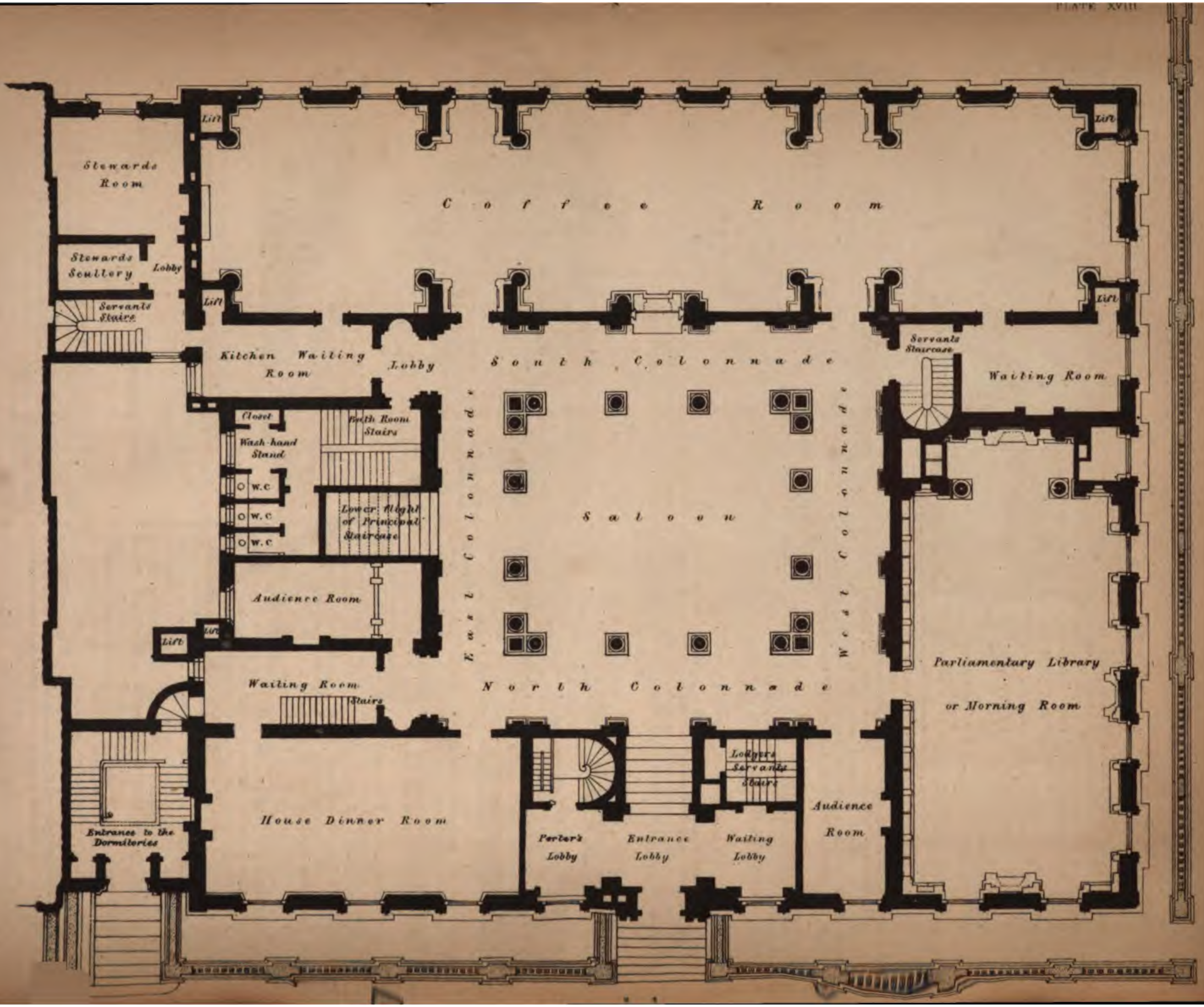
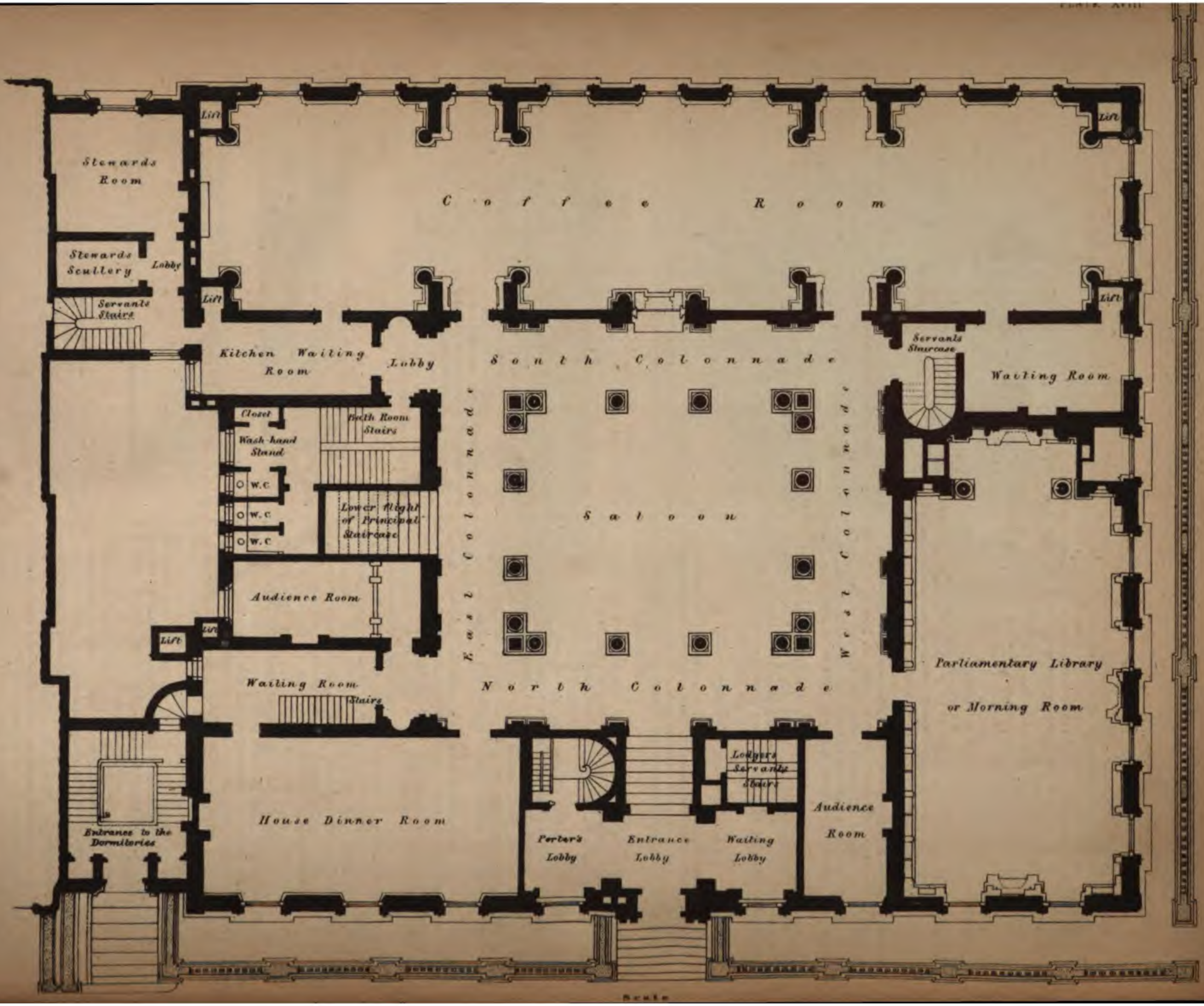
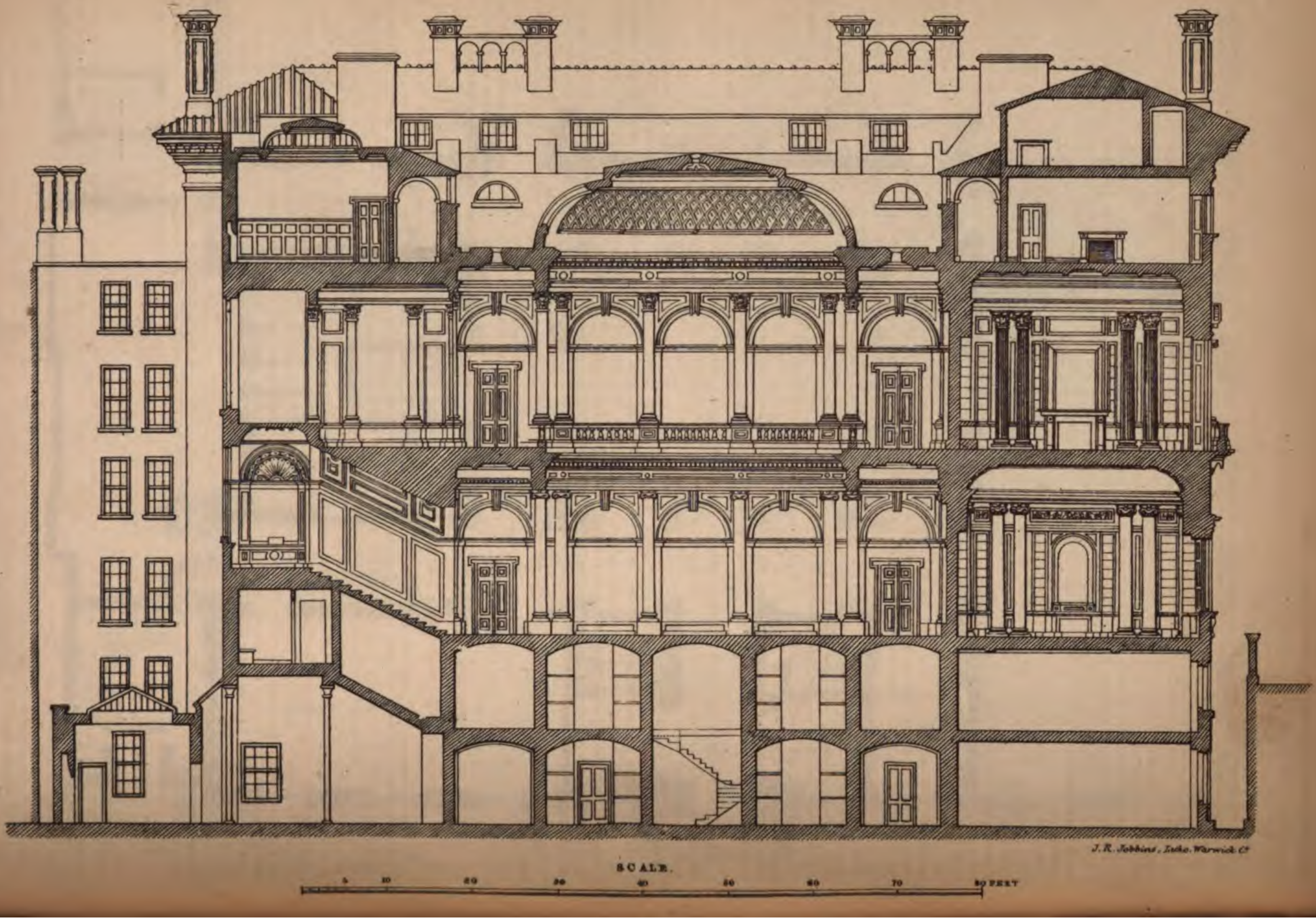

Lift
Lift
Stewards Room
Coffee Room
Stewards Scullery
Lobby
Lift
Lift
Servants Stairs
Servants Staircase
Kitchen Waiting Room
Lobby
South Colonnade
Waiting Room
Closet
Bath Room Stairs
Wash-hand Stand
W.C
W.C
W.C
Lower flight of Principal Staircase
East Colonnade
Saloon
West Colonnade
Audience Room
Lift
Lift
Parliamentary Library or Morning Room
Waiting Room
Stairs
North Colonnade
Lodgers Servants Stairs
Audience Room
House Dinner Room
Entrance to the Dormitories
Porter's Lobby
Entrance Lobby
Waiting Lobby

Plate XVIII


Stewards Room
Stewards Scullery
Lobby
Servants Stairs
Lift
Lift
Lift
Lift
Lift
Lift
Coffee Room
Kitchen Waiting Room
Lobby
Closet
Wash-hand Stand
W.C
W.C
W.C
Bath Room Stairs
Lower flight of Principal Staircase
Audience Room
Waiting Room
Stairs
Entrance to the Dormitories
House Dinner Room
South Colonnade
East Colonnade
Saloon
West Colonnade
North Colonnade
Servants Staircase
Waiting Room
Parliamentary Library or Morning Room
Lodgers Servants Stairs
Audience Room
Porter's Lobby
Entrance Lobby
Waiting Lobby
Scale

Reform Club House

Section from East to West through the centre of Saloon and First Floor stairs



J. R. Jobbins, Litho. Warwick Ct

ed and published by Medhurst,—it follows that to Clegg and Samuda is due the credit of perfecting what he began.

Now let us see what Mr. Pinkus has done. His first patent we find is dated 1st March, 1834, in this he sets forward a combination precisely similar to that published by Medhurst seven years previously, only proposing to use a rope for his continuous valve, which he terms a valvular cord, and which he describes thus: "A flexible cord E lies in the groove at the top of the cylinder, for the purpose of closing the longitudinal aperture; this cord is to be of the same length as the pneumatic railway, and to fit tightly into the groove or channel. The cord is passed under the wheel c, and over the wheel P; and its purpose being to close the opening in the cylinder, it is required to yield freely when acted upon by the apparatus, and it should be made heavy, and it may be pressed down into the groove by the wheel W, which passes over it."

Now if Mr. Pinkus can prove any better result to arise from this rope than from the valves suggested by Medhurst, he has a perfect right to it. We fear, however, that the success he says, attended his experiments made in 1835 on a model, could not have been very flattering, as we find he took out another patent in 1836, "For improvements in inland transit," in which he says, "the method of carrying it into practice consists in a method or in methods of constructing the pneumatic valve and the valvular cord, and in the manner of using the same, one of which methods hereinafter described, I design *to substitute for and in lieu of the valve and cord described in the specification of my said former patent.*" He then goes on to describe a valve formed of iron plates secured to felt to lay against pieces of wood, which he proposes to fix to the inner sides of the trough, as presenting a smoother surface than cast iron. He next describes a spring copper valve fastened at its foot to the pipe, and meeting at the top in the shape of an inverted V; and lastly, a combination of the two, viz., using half the spring copper valve against the upraised side of the trough, and pressing it against its surface with the valve with iron plates, as before described, which in this case acts as a wedge pressing against the side.

These valves, however, could not have pleased him much better, for on 3rd August, 1839, he obtained a third patent, in which he not only describes a valve similar in every respect to that of Messrs. Clegg and Samuda, but also proposes to seal it with a composition to be rendered fluid and solid, as described by them; with the sole exception of using a galvanic wire instead of a heater to melt the cement. As this patent was enrolled eight months *after* the publication of Clegg and Samuda's specification, we cannot but think that their invention was instrumental in leading Mr. Pinkus' ideas to this valve, as nothing of the sort is discoverable in either of his previous patents.

[Erratum.—For 1837 read 1827, p. 407, 2nd col., 4 lines from the top.]

REFORM CLUB-HOUSE.

(With 2 Engravings, Plates XVIII. & XIX.*)*

Fully to describe and explain the interior of the structure would require a plan of every floor—amounting altogether to six, besides as many sections, to say nothing of particular sections on a larger scale, of some of the rooms, perspective views, and drawings of ceilings and other details: in short it would demand a volume similar to that on the Travellers' Club House.* Of course we cannot devote so many engravings to a single edifice, though it be one so deserving of attentive study as this of Mr. Barry's; nevertheless a sufficiently clear idea of the general arrangement, of the sizes of the rooms, and of the height of the different stories, may be obtained from the ground floor plan and section through the building from East to West. Being confined to a single section, we have judged this last to be the best for our purpose, because although one through the centre from north to south, would have shown the ascent from the vestibule to the hall, and the coffee-room and drawing-room above it, it would have shown merely the end elevations of those apartments, not their longitudinal ones—which are their more important ones; whereas the line of section chosen makes no difference as regards the hall, while it explains the character of the staircase, and the room over it, and also shows the kitchen court, at the east end of the building. When, however, we say none, we mean that it makes no other difference in respect to the hall itself than what is evident from the ground plan, namely, that in this direction the three intercolumns are of equal width, whereas the east and west sides being somewhat shorter, the lateral intercolumns are narrower than the centre one, on which account those elevations are better than the others, where the columns are wider apart than is altogether consistent with the richness of character here observable in other respects. This excess of width in the intercolumns is not so apparent in our drawing, because that being both a geometrical and outline one, it is the plan which chiefly explains that the arches between the columns belong to a different plane, viz., that of the wall within the colonnades. Hence it is likely enough that from the first glance at the section it will be supposed that, instead of being insulated the columns are attached to the piers of the arches, in which case the intervals between them would not be too great. It becomes a question, therefore, whether it would not have been better, to enclose the lower part at least of this saloon by open arcades so decorated, whereby a character of solidity would have been there produced, that would have served to relieve and set off the upper colonnades. Still wherefore that idea—supposing it to have presented itself—was not adopted is sufficiently apparent from the plan being neither a perfect square, so as to allow three arches of equal width, on each of its sides; nor so much greater than a square as to afford five spaces—whether arches or intercolumns, on each of the longer sides. Perhaps as the deficiency in the breadth from north to south, could not be supplied without intrenching too much upon other parts, it might have been adviseable to have got rid of the excess in the other direction, curtailing—not the entire hall, but merely the cetral space within the columns, reducing that to a perfect square. By this means, indeed, the breadth of the east and west colonnades would have been somewhat increased, yet that objection might have been got over by apparently contracting the width, putting columns against the wall, corresponding with those in front, and so as to render the distance between them equal to the breadth within the north and south colonnades. This adjustment of the plan, reducing the centre to a square of 28 feet, instead of 34 × 28,—might have rendered some other modifications requisite, and among the rest, some abatement of the present height.

If we have thus far taken the liberty of objecting to what we regard as a rather offensive irregularity as regards the colonnades, we commend the mode of grouping of two columns and square pillar, here employed at the angles, which produces a very desirable fulness of effect, as well as appearance of solidity at those points, and at the same time avoids the confusion—and perhaps heaviness withal—that might have resulted from three columns similarly placed. Another pleasing and, we believe, original circumstance is, that in the upper and lower colonnade on the south side, a view is admitted into the coffee-room and drawing-room over it through the centre arcade, which is to be filled in with plate glass to within a few feet of the floor, that is, to the level of the chimney-piece. By this means, the saloon itself will always present a striking architectural scene as so viewed from either of the two principal apartments, especially of an evening when brilliantly lit up. The mode also of lighting the saloon entirely through the cove, appears to us both a novel and happy one, although we can at present merely guess at its effect, it being quite blocked up with scaffolding when we last went over the interior of the building, when very little progress had been made in the decorations, or rather, they were hardly commenced at all, nor was it began to be paved. The staircase was also then a mere shell, with brick walls, and without any steps. Consequently, until we can see the interior again, in a much more advanced, if not perfectly finished state, we can add very little to the information the plan and section supply as to the parts just mentioned. For which reason, we must be allowed to reserve further description for another opportunity, and request our readers to consider the present account merely a provisional one.

Ryde, Nov. 7.—The committee appointed to decide on the plans for our new church, have selected the designs of Mr. T. Hellyer, architect. It is a handsome structure, and the interior is composed after the model of the Temple church in London. The subscriptions for the building are progressing steadily, and the contributions for enclosing the new burial-ground already amount to more than 150*l*. Too much praise cannot be given to our vicar, the Rev. W. S. Phillips, for the energy and exertions he has put forth to accomplish these two important objects.—*Hampshire Advertiser.*

---

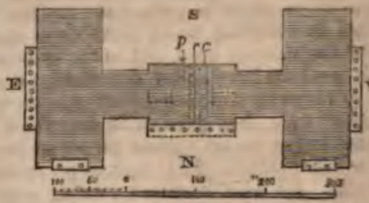
* The whole of the plates in that work have lately been pirated in the most barefaced manner by the editor of the Revue Generale d'Architecture, without the slightest acknowledgement, or mention of the source whence they have been taken, notwithstanding that a copy of the publication was actually given to the French editor in order that he might give a notice of the book! Yet instead of doing any thing of the kind, he does not even inform his readers that there is such a volume in existence, but makes it appear that both his article and the plates are entirely his own, and the information collected by himself while he was in London. It is true the drawings are not exactly facsimiles, for they are considerably reduced in scale from the originals, and in other respects far less satisfactory: still that circumstance does not cancel the act of piracy, or the injury done by it to the English publisher.

ARCHITECTURE OF LIVERPOOL.

Sir—When I first saw the remarks of your correspondent "Eder" in a Liverpool paper, I felt strongly disposed to make a few observations in reply to some of them, which seemed to me strangely at variance with his professions of careful and long continued architectural study. This inclination was confirmed when I found they had obtained a place in your journal, and would thus fall under the notice of so many interested in the matters they refer to. In putting this design in practice, I shall borrow his introductory paragraph, in so far as it relates to partiality and prejudice, both which feelings so inimical to all fair discussion, I can most candidly disavow.

The Custom House is the first building noticed by Eder—its size perhaps entitles it to such priority. He applies the terms "imposing and magnificent," to this structure. Now any very large mass of building may be allowed to be *imposing*, if of an adequate height, but magnificence implies something more than mere mass of material and extension of surface: it includes, I conceive, a symmetrical arrangement of parts, fine proportions, and a degree and character of ornament suited to the importance and purpose of the building. In these three points I hold the Liverpool Custom House to be most lamentably deficient. First, as to *arrangement* or *composition*. The building is on a plan much like the letter H, the cupola occupying the centre of the cross part of the letter, and a portico on one side of the cross, and on each of the upright parts. The consequences of this arrangement are destructive of all fine perspective effect, for when viewed on its north front, the cupola serves only to destroy the effect (such as it is) of the portico on that side, and seen from the east and west fronts that feature seems hardly to be part of the pile, so completely is its connection with those fronts hidden by the projection of the wings. This cupola (in his opinion, in which every body I imagine must agree with your correspondent), in fact never terminates the perspective from any point of view, nor combines with any of the intersections of the wings and central portion of the mass. With regard to the position of the porticoes, that to the north is buried between the wings, and can never be seen in profile. and its projection is so slight that were it not that the only light it ever receives from the sun falls very much aslant, and consequently gives a great prolongation of shadow, it would have no more relief than a row of attached columns with a pediment over them. The above remarks as to want of projection, apply with greater force to the other two porticoes, which however *can* be seen in profile, or obliquely, though for reasons I shall point out when I come to speak of the *proportions* of the parts, their effect is completely destroyed. The site of this building was well adapted to a cruciform plan, and had such an arrangement been adopted, the porticoes, however deficient in projection and depth, would at least have formed suitable terminations to the several portions of the cross; and the cupola, however foreign to this, so called, Grecian design, would have risen naturally, as I may say, at the intersection, and have terminated the converging perspective of the body and transepts with good results as regards its own effect and importance, and without interfering with the porticoes in those respects. Such a disposition of the plan would also have insured a better distribution of light, and greatly have benefitted the interior arrangements, which as your correspondent justly observes, are sadly wanting in this point. As regards the proportions of the several fronts, and the features which compose them, it seems to me that very little consideration, or consideration to very little purpose has been bestowed on them, more especially as respects those very important parts of the composition, the porticoes. Their projection (for they are all alike) is so slight as to appear nothing in comparison with their frontal extent, and to take away all idea of shelter or shade. I do not know whether Candidus will include expression as one of the banished or obsolete architectural terms, but this quality (for I for one believe in its existence) appears to me to be utterly wanting in three of the fronts. As I wish to advance nothing without endeavouring to give a reason, I shall explain myself as well as I can. I am of opinion, then, that there are two general proportions in which a portico may be combined with a front, of which it does not occupy the whole extent, without loosing its own effect, or interfering injuriously with that of the front of which it forms so material a feature. These proportions seem to me to be firstly, such as shall give to the portico the greater part of the façade, and make the remainder on either side appear as mere adjuncts or accessories thereto; or secondly, such as shall make the portico a subordinate feature in the design, leaving an extended surface on either hand. In the first case the impression on the mind will be (such at least is the effect with myself,) that the front being of a proscribed extent both as to length and height, and a portico a requisite part of the edifice, that portion had been kept within the extreme dimensions of the site for the purpose of preserving to it a fitting proportion as to elevation: and in the second, that the portico being as before supposed a necessary and ornamental feature in the proposed arrangement, had been so proportioned to the whole extent of front as not to destroy its unity and continuity of appearance. The expression of the first named portico, I conceive, will be found that of dignity and grandeur combined with use, and that of the second more allied to comfort and convenience judiciously united with a due regard to ornamental effect. Of the first mentioned proportion I consider the portico of the Fitzwilliam Museum at Cambridge, a good example. As a specimen of the second I may quote that of the India House, inharmonious as that front may be in some of its details. In spite of what I have said above, I still greatly prefer the truly Grecian application of the portico, where it includes the whole front of the building, and continues without interruption or break, save its own angle, the order or entablature, as the case may be, of the lateral portion. But to apply these remarks to the building under consideration.

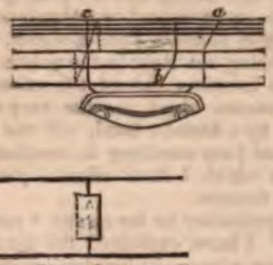
Fig. 1.



The east and west porticoes of the Liverpool Custom House occupy, to my eye, exactly the unhappy medium between the proportions I have attempted to describe; and instead of leaving the mind at rest to contemplate and enjoy their air of simple dignity, or of inviting and hospitable shelter, together with the varied effects of light and shade of which these beautiful architectural features are capable when happily conceived and applied, they distract the eye, both mental and physical, by a puzzling uncertainty as to the meaning of the architect, and by their bareness and lack of depth give no idea but that of useless show, and of an exposed, comfortless, and contracted entrance passage. With regard to the north or principal front, the portico has an advantage over those of the east and west fronts—having in rear a slight projection of its own width from the main building; this gives an appearance of greater projection from the general line, but is of no avail as regards the shallow and ineffective aspect arising from deficiency of depth. The proportion which this portico bears to the whole space between the wings is nearly the same as the two already described bear to their respective fronts, and it appears to me to labour under the same uncertainty as to whether it be a principal or accessory in the general design. The wings themselves are perhaps not too far in advance as respects their own proportion as *wings*, but they unquestionably do stand out to such a degree, as to drown completely the portico and its adjoining projection. The fronts of the wings which consist of openings of three intercolumniations divided by two columns in antis, and a flank of about two intercolumns pierced with windows, on each side, are certainly the most effective and least objectionable parts of the front under notice, but I am inclined to think that a greater height of blocking either over the whole front, or at least over the central portion, would tend to improve their aspect. I come now to speak of the rear or south elevation which Eder describes as "infamously miserable,"—terms which well apply to the whole of the wings on that side, but not, I maintain, to the main front which comprises, in my opinion, the only really redeeming feature in the whole building.

All pretension to Grecian character appears here to have been abandoned. The cornice of the columnar order is, to be sure, continued, but without the frieze and architrave, and being of good projection, with a massive dentil member in the bed-mould, it harmonizes well with the general character of this portion of the building, which is most decidedly Italian. Though I think the central projection of this front is, like those in the others, faulty in its indecision of proportion to the whole, still, in itself, I consider it in all respects much the best part of the structure. It consists of a plain well-proportioned elevation, divided into three parts by two slight breaks. The middle portion of the three is pierced below by three open segmental arches leading through the building to the opposite front; and above these, three semicircular-headed windows of good proportions, and pleasing though simple character. The lateral divisions have above each, one window corresponding with those of the centre; and below, a window recessed in an arch similar to those forming the three openings above mentioned. The front is divided horizontally by a bold string course, and surmounted by a massive but suitably proportioned plain attic wall, with its cornice and blocking. The impost moulding of the upper windows is also carried through, which lightens, without too much cutting up, the massive and substantial piers which divide them. There is a good height of plain wall between these windows and the cornice, which, in my opinion is a great assistance towards gaining dignity of aspect, giving me always the same kind of impression as a lofty forehead surmounting a human face. The solid and void are, I think, very happily apportioned in this front, and though I could wish for a better description of rustic work than the horizontal channels in the basement, still the effect of the whole is simple, substantial, and dignified. Here, and here only, does a cupola, supposing it to be something very different from that which really exists, not appear misplaced. The attic wall hides the roof completely, and conveys the idea of a solid support for the mass above it, and the breaks dividing the front are so proportioned as to carry the eye easily upwards to the plinth or stylobate of the cupola, which falls just enough within their line to give the appearance of a proper degree of stability. In the article of decoration, which I mentioned as the third requisite to fill up my idea of magnificence, the Liverpool Custom House offers but little for our consideration, and the quality of what exists can hardly, I imagine, excite a wish that there was more of it. It is difficult to conceive that Greek details could be applied with a more complete absence of all classical effect and feeling. Unfluted Ionic columns, with fluted tori in their bases, composed each of eleven stones; pilasters with capitals, whose mouldings are certainly copied from Greek examples, and enriched, according to established use, with water-leaf, &c., but which mouldings, alas, project more than three times as far beyond the faces of the pilasters, as the pilasters do from the wall, the projection of these latter being barely 3¼ inches to a diameter of 4 ft. 6 in. The projection of the entablature follows, of course, that of the pilasters, and shares in their meagre aspect. In the architraves of the porticoes it appears that stone could not be obtained in sufficient lengths to bear from column to column, and the architect has had recourse to the method of notching shown in Fig. 2.

Fig. 2.



Plan of joint at C.

The effect of this mode of jointing is, that in one portico the part marked *a* has broken through and the stone fallen considerably out of the horizontal, a defect which is only too clearly shown by the broken lines of the tenia moulding and the faces of the architrave; and in another a fracture has occurred as shown at *b*, but not to the same extent. Might not these evils have been avoided by showing a vertical joint in front, and backjointing the stones as shown by the dotted lines at *c*. This must be considered a digression as it belongs rather to the constructive part of the matter; but it was mentioned for the purpose of calling attention to the bad practical effect, of a mode of construction which is in itself an eyesore, and which is enhanced in the present case by the fact, that the stones resting on the columns are almost uniformly some degrees darker in colour, than the intermediate ones which are notched into them. Through some defect, as I imagine, in the foundation, a very serious fracture is visible in the N. W. wing over one of the windows within the recess. But to return to the details; the stylobate so much commended by Eder is a plain square plinth, projecting just sufficiently to receive the bases of the very slab-like pilasters I have described, whose moulding is also, as noticed by your correspondent, carried entirely round the building, with the exception of the south front and wings. This stylobate is certainly much too low to be in proportion to the order—as to the doors and windows, I marvel much what any one can find to admire in them. The windows, except those I have mentioned in the south front, and similar ones under the north portico, are either plain oblong holes, or have a meagre ghost-like architrave, without even the knees or projections at the upper angles to be found in the only genuine Grecian example of such features in the Erectheum. The doors *may* be copied from Greek examples; but who can say that the upright unenriched cyma, is not an ungraceful member? I imagine that the very vertical profile of these mouldings, was adopted in the originals for the better display of the ornamental surface, which decorated them; but as here applied, in their naked state, they are positively ugly. The trusses of the doorways are, to my eye, little less unpleasing, and the nature of the stone and quality of workmanship, give no great effect to what ornaments they can boast. I have as yet said nothing of the interior, or of the details of the cupola. The whole of the former is not yet opened to the public, the fittings of the long room being incomplete. Having had a view of this room, I can only say that it seems to me no great improvement on the exterior. The plan is confused and choked, and the effect of space destroyed by the numerous columns, which, in their disposition, evince a singular disregard to any regular arrangement. The internal cupola, which springs from pendentives rising upon the entablature of the Ionic order of this room, is spacious, and considerably enriched, but claims no notice on any other grounds. On its exterior companion I must decline making any remarks, as my disclaimer of prejudice might perhaps not avail me, were I to say all I think of it. I believe, however, the original design of the architect was not so utterly tasteless. That part of the interior already occupied is sufficiently and fairly described by Eder, being very dark and inconvenient. I have trespassed long on your valuable space; my excuses are that a great deal of unmeaning, and I think ignorant admiration has been bestowed on this structure, both by residents and visitors; that I have never heard a reason given for any thing which has been said in its favour; that all that is the least good in it seems to have been uniformly overlooked; and that it is one of the most extensive and costly buildings which have been erected in this country of late years, having occupied more than ten years in completion, and having cost, as I have been informed, a sum approaching £400,000. In conclusion, I hope I have said nothing to impugn my opening professions of impartiality. Let those who have seen this building judge for themselves, and if, in comparing these remarks with the original, they consider the objections urged beyond the bounds of just and fair criticism, I hope they will, as I have endeavoured to do, give the reasons which influence their opinions; should such meet my view or that of others who think like me, I hope they will be judged of in the spirit of candour, which I trust has guided my pen in the foregoing observations.

Your's, &c.,
H.

Liverpool, Nov. 9, 1840.

Since the above remarks were written, the Long Room has been completed and opened for business. I have only to add, as regards this room, that, although a vista is preserved through its entire length, the effect is destroyed before one third of that length is traversed, by the confused appearance presented by the columns. This arises from the strange indifference here manifested to regularity of intercolumniation, which is such that, looking on either side of the room, no two pairs (not couples, for there are no really coupled columns, however nearly they approach such an arrangement) of columns seem equally far apart. The coffers of the cupola appear much too shallow, and the mouldings as much too large for the depth of the coffers, though perhaps not so when viewed, with respect to their surface, rather than their depth.

VICTORIA ROOMS, BRISTOL.

Sir—The portico of the Victoria Rooms, Bristol, although correctly placed in the Octastyle Class in the table of porticoes given in the Civil Engineer and Architect's Journal for this month, is therein stated to have five intercolumniations, a contradiction which you may not perhaps think it necessary to explain; allow me, however, to add that there is an important omission in the description of it, as the pediment I am happy to say is sculptured, or more properly is being sculptured, from a working model by Mr. M. L. Watson, the principal relief from the face of the tympanum being 2 feet 3 inches. I shall feel obliged by your attention to this letter.

And remain, Sir, your most obedient servant,
Charles Dyer.

36, *Guilford Street, Nov.* 11, 1840.

ON THE DRAINAGE OF LOW LANDS.

By Mr. William Fairbairn.

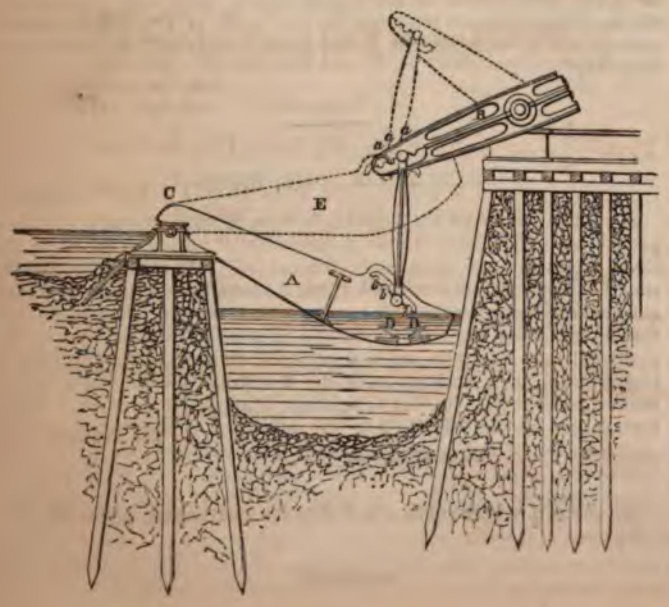
There are few subjects of more importance or more deserving of public attention than the drainage of lands. In cultivating land below the level of the sea, drainage is one of the first steps, for unless the superfluous waters of a low marshy district be freely removed and discharged at a level above its surface, it is in vain to look for productive crops, however rich the soil or the alluvial deposit may be.

Hydraulic machines of almost every description have been in requisition for this object, and in countries, such as Holland and the Fen districts of Lincolnshire, where the land is in many instances several feet below the sea, those machines have been extensively used, and many improvements have from time to time been introduced. Formerly windmills and animal power applied to scoop-wheels seem the only methods adopted, but since the introduction of the steam engine a material change has been effected. Engines of great power may now be seen giving motion to wheels of 25 to 30 feet diameter, discharging large quantities of water from the lower to the higher levels.

The scoop-wheel, although a simple and effective machine, is not (according to Mr. Fairbairn's opinion), the most economical for the drainage of low lands. In countries where fuel is expensive, it is an object of great importance to obtain power at a cheap rate, and by the application of the steam engine upon the Cornish principle, a saving of three times the fuel now consumed may be effected. The consumption of fuel by a well constructed condensing engine is from 10 to 12 lbs. of coal per horse power, per hour, or 10 lbs. of coal will raise 2,000,000 lbs. of water one foot high in a minute; whereas a single acting Cornish engine, according to the returns, will raise with the same quantity of fuel 8,000,000 lbs.—a duty four times greater than has yet been attained by the common condensing engine. Taking it, however, at only three times the duty, or 6,000,000 lbs. one foot high in a minute, the saving is even then so great, as to be entitled to the attention of proprietors whose lands are situated at a level requiring the aid of steam to clear them of water.

From these considerations it appeared to Mr. Fairbairn desirable to apply the Cornish engine, and having been requested by parties interested in the drainage of the Lake of Haarlem, to consider the best and cheapest means for the attainment of that object, he proposed a machine, of which the following is a description.

In raising water by the scoop-wheel, it is obvious that a uniform force is necessary to overcome the resistance upon the floats, as they successively discharge their contents from the lower to the higher level. This resistance being constant, the force applied, and the quantity of fuel consumed, will be equal to the load, or to that of a low pressure condensing engine, similarly constructed to those on board of steam boats. The effect produced on the bailing-scoop will be totally different, and instead of a continuous action as exhibited in the common wheel, a reciprocating motion will be produced, and the same economy insured as is now exemplified in the returns of the Cornish engines. In applying this description of engine it becomes necessary to adopt the reciprocating principle, and by raising a weight suspended at the opposite end of the engine beam B, the large bailing-scoop A, revolving on a fulcrum at C, descends to the lower level, and is filled with water through the opening valves D, D. The weight having been elevated to the full height of the stroke, it descends by the force of gravitation, and raises the bailing-scoop to a horizontal position as at E, causing the water to flow over the pivot C, into the level above. The same process is repeated, each stroke by the admission of steam into the cylinders to raise the weight, and the bailing-scoop is again elevated by its descent.



The principal advantage peculiar to this machine, is its adaptation to the single-acting Cornish engine; first, by the introduction of a portion of high pressure steam to overcome the inertia of the weight; secondly, by its subsequent expansion to maintain the momentum; and lastly, by the gravitation of the weight to lift the load; on the same principle, in fact, as the engine at the East London Water Works, under the direction of Mr. Wicksteed, and as those in Cornwall.

The bailing-scoop is 25 feet long and 30 feet wide, composed of boiler-plates, with two partitions to strengthen the bottom and support the valves for the admission of water at D. The machine is calculated to raise about 17 tons of water each stroke, and with an engine of 60 horse power will effect a duty equal to 2½ or 3 lbs. of coal per horse power, per hour. It will be observed that the length of the stroke continues at all times the same in the cylinder, whilst at *a a*, *b b*, &c. it is varied by a series of stops fixed horizontal to the sides of the engine beams, and upon inclined planes on the bailing-scoop. This is done in order to lessen or increase the dip, and to accommodate the lift to a height commensurate with the difference of the levels which may exist between the surface of the lake and the height to which the water has to be raised.

ON THE COMBUSTION OF COAL.

Sir—Having lately submitted to the public an improved mode of introducing air to the gaseous matter of coal in a furnace, by which its complete combustion is effected, and the generation of smoke necessarily prevented; and finding that the principles on which this is produced have been misrepresented or misunderstood by the contributors to some of the public journals, I am desirous, through the medium of your columns, of being set right in the public view on this important subject. In some instances, indeed, the effect produced by my mode is attributed to causes which are the very reverse of the fact, and though evidently by a friendly hand, yet the result is so opposed to chemical truth, that I am unwilling to sanction such an explanation of the principles on which I have effected perfect combustion on the large scale of the furnace.

In the treatise published by me on the "combustion of coal, chemically considered," I have explained the source of those errors into which the patentees of "smoke burning" systems have fallen, by their search after a high temperature, and looking to that temperature as the means of consuming the gas or smoke, to the utter neglect of all that regards the quantity of air admitted to the furnace, or the conditions on which it combines with the combustible. In that treatise I have mainly relied on the fact that the question of effective combustion is a question as regards the *air*, and not the *temperature*. Modern patents have run on the erroneous idea that the gas evolved from coal in the furnace, and from which flame is exclusively derivable, is to be consumed by bringing it into contact with a mass of highly ignited carbonaceous, or coky matter. This I deny, and consider it to be not only a chemical fallacy, but a great practical error. On this ground, therefore, I am unwilling to be considered as regarding the question of a high temperature as the essential to the ignition or combustion of the gaseous matter of coal. My mode of effecting combustion, by introducing air to the gas in the way of numerous jets, depends for success on principles quite distinct from those which are attributed to the action of heated air. By one writer, the effect of my system is stated to be attributable to the circumstance of the air being heated in the passage through the diffusion tubes; now these tubes are used by me for the sole purpose of throwing the air into small jets, corresponding, in principle, to the jet from a blow pipe. This mode of explaining my principle goes neither to the right cause or effect.

So far from the tubes or pipes, which are made of fire clay or cast iron, heating the air in its passage through them, I have proved, practically, that the combustion goes on equally when the tubes are black and cold, and the air passing through them necessarily cold; this cold air, on issuing from the numerous small orifices, conveying the idea of jets of *flame* rather than *air*. It is important to state that I place no reliance on the question of the temperature of the admitted air.

It has been stated in explanation of the effect produced by my diffusion tubes, that as there is always plenty of air, or oxygen, in the furnace, and a deficiency of heat, the introducing the air at a high temperature, supplies this deficiency. This is directly the reverse of what I have stated to be the condition of the furnace, and the flues leading from it. The following extracts from my tract will put this in a clear point of view.

At page 124, I state, "The leading condition of the combustion of the inflammable gases being the *mixture* with the oxygen of the air in given quantities, and at a given temperature, those inventors have in too many instances, to the utter neglect of the former, exclusively directed their attention to the latter,—the obtaining the highest degree of heat, even to incandescence, for the gases. Now this is unquestionably the condition which demands the least attention on their parts, if *any at all*."

Again, page 129, "It is the palpable oversight of the distinction between increasing the *faculty* of combustion, and actually producing that combustion, which has led to that manifest chemical blunder,—the supposing that coal gas is to be *burned* by the act of bringing it into contact with bodies at a high temperature: or, in the words of the patentees, by 'causing it to pass through, over, or among, a body of hot glowing coals.' In our efforts then, towards effecting the combustion of the gaseous products of coals, it is essential that we steer clear of this hitherto unquestioned practice: attending solely to the question of *air*, and all that has reference to its introduction, distribution, and diffusion: for we may take it for granted, that the condition of *heat* is but a secondary condition; and that the required temperature will never be wanting in the furnace, from the moment we '*light the fire*,' if air be supplied in the proper quantity, at the proper place, and in the proper manner: but if these conditions be not satisfied, an accession of heat cannot remedy the evil, however it may aggravate it."

I assert then, that there can be no greater fallacy, than supposing that giving a high temperature to the air admitted, can be the means of effecting the combustion of the gases, or the prevention of smoke. An analogy has been drawn between the effectiveness of hot air in the manufacture of iron—this however bears no analogy with the introduction of hot air to the furnace, as the means of effecting combustion or preventing smoke. With your permission I propose considering this point on a future occasion—at present I confine myself to denying the assertion that my plan obtains any advantage from the circumstance of the air being heated in its passage into the flues through the small orifices of my diffusion or distribution tubes.

I am, Sir, your's, &c.

C. W. Williams.

Liverpool, Nov. 20, 1840.

THE NELSON MONUMENT.

Sir—Since I last addressed you, the first stone of the Nelson Column has been laid, the work is progressing rapidly, and will continue to do so until the public rise en masse to protest against so great an outrage upon the principles of beauty, or, peradventure, the subscriptions be, as at present, insufficient to complete the structure. We shall then have a piece of a column, to show succeeding generations the lofty standard of beauty amongst us, and to point out how *we* delight to honour the great, the virtuous, and the brave. Shall we, the British nation, permit this living libel to appear against our love of art; glorying in the matchless works of our ancestors, shall *we* allow posterity to point with derision to the evidence of their effect upon us. Enough has been said to show that the Nelson Committee are alone in their project, and it will be disgraceful, if the public submit to have this column thrust upon them, in opposition to their better judgment. Those journals in which we place most confidence in matters of taste, the Athenæum, the Literary Gazette, and the Art Union, have all protested against the proposed column; but despite this and the positive opinion of the Select Committee of the House of Commons, the projectors pursue their object *per fas aut nefas*, and the stone which Wellington would have been proud to lay, is laid, with no public announcement, and no popular enthusiasm, by the Secretary of the Committee. We do not hesitate to say, despite the expression of condemnation upon the whole building, that the *portico* of the National Gallery, exhibits many architectural beauties in its internal columns, and the depth of shadow caused by the projection of the antæ in front of the wall, and it is the portico which the pedestal of the column will completely hide. With all deference to one whose opinion as to the good effect in juxta-position of colossal, and ordinary proportions, demands from all, the highest respect, I would beg to notice that St. Peter's at Rome, has been objected to on account of the enormously disproportionate figures lessening the effect of the architecture, and St. Paul's itself, for the difference in size of its two internal orders. Sir F. Chantrey in his evidence as to the effect of the column as an ornamental object, says, "the Trajan, the Antonine, and the Napoleon columns are the only monumental objects of this class that I have ever looked upon with entire satisfaction; I read the history of the man on the shaft of the column, and the mind is thus reconciled to see the statue so elevated. I may be told we have not money enough for a work of this character, that naval exploits furnish bad materials for sculpture, or that the arts of this country are in too low a state to accomplish so noble a work; then I say, abandon the impossibility at once, and try something more in keeping with our means and our genius." The "general observations by T. L. Donaldson, Esq.," contain opinions as to the bad effect of a naked column. If, therefore, it can be shown, not that the funds do not suffice to enrich the shaft with bas-reliefs, and crown the column with a statue of bronze, but that the subscriptions are actually inadequate to complete the denuded shaft and the perishable statue, and if in addition to these sufficiently cogent reasons it can be proved, that a colossal column, when used without the structure of which it is as much a part as the leg is of the man, is an outrage against our most cherished principles of beauty,—it becomes the people to protest loudly and speedily against the infliction of so great a national indignity.

I am, Sir, your obedient humble servant,

A Lover of the Beautiful.

36, *Tonbridge Place, New Road,*
November 20, 1840.

ON COMPUTING EARTHWORK.

Sir—Observing an article in your October number, page 334, on the methods of computing Earthwork, by Mr. S. Hughes, in which the writer asserts, that the tables of Messrs. Macneil and Bidder, "are useful only for calculating sections where the scale is very small, and where the heights cannot be taken otherwise than in feet—and that where the scale is sufficiently large to show the heights in feet, and decimals of a foot, they are of no use." I take the liberty of transmitting to you the following for the purpose of proving that the tables of Messrs. Macneil and Bidder, are as useful for such calculations, where the heights are in feet and decimals, as in feet only.

I have at present the tables of Mr. Bidder only at hand, although I constantly make use of Mr. Macneil's for similar calculations, but an example based on the tables of the former gentleman will be equally illustrative of the use to be made of those of the latter.

For my purpose I have selected the same example as Mr. Hughes, in page 336.

Example.—Suppose a piece of cutting or embankment 39·8 feet deep at one end, and 24·6 at the other end, the base or top 30 feet and slopes 2 to 1, required the area, which being multiplied by the length, shall give the true content.

	Mid. part.	Slopes.
Intersection of columns 40 and 25, gives	79·5 and	2628.
Ditto ditto 39 and 24, gives	77 and	2471.
Difference	2·5 and	157.

Then $\frac{{\cdot}8+{\cdot}6}{2}={\cdot}7,\ {\cdot}7\times 2{\cdot}5=1{\cdot}75,\ 1{\cdot}75+77=78{\cdot}75$ mid. part,

${\cdot}7\times 157=109{\cdot}9,\ 109{\cdot}9+2471=2580{\cdot}9$ slopes.

Mid. part $78{\cdot}75\times 30=2362{\cdot}50$

Slopes $2580{\cdot}9\times 2$ to $1=5161{\cdot}8$

Total contents in yards per chain 7524·3.

Then $\frac{7524{\cdot}3}{22}\times 9=3078{\cdot}18$ correct area.

In practice the last operation forms no part of the calculation, as the lengths are taken out in chains and decimal parts.

I remain, Sir, your obedient servant,

Geo. B. W. Jackson.

Radcliffe Terrace, Goswell Road.
Nov. 24, 1840.

[The above is a very round about way for ascertaining quantities, to say the least of it.—Ed.]

RAILWAY MANAGEMENT.

Sir,—Before railways can ever be expected to be properly managed, several important alterations must be made in the present system. In the first place, the Directors must effectually suppress the propensity to *amateur engineering* on the part of the "clever practical men" of their body, of whom all boards have more or less. In the next place, they must make a common sacrifice of all patronage and personal consideration in the appointment of persons to situations, when any neglect would be likely to be followed by danger to either life or property. Were this system to be fairly and honestly acted upon, I have no doubt the necessary result would be the appointment of an individual, to whom would be confided the *entire* and *uncontrolled* management of the whole of the *out-door* business of the railway. To him would be committed the whole charge of the selection, employment, pay, and superintendence of every engineman, fireman, guard, porter, rail-layer, and labourer on every part of the line, any of whom he should fine, punish, or dismiss at his pleasure, and on him, and him *alone*, should rest the responsibility, both with respect to the public and the Directors, of every hindrance or accident which might occur. In proportion to the success of his management he should be paid, and on his appointment it should be distinctly intimated to him, that in the event of his being found unfit for his office, or even *unfortunate*, no hesitation or delicacy would be observed with respect to his dismissal and the appointment of another in his room. Any person aware of the importance of the duties which would devolve on an officer of this description, would at once perceive that they could not be properly and efficiently fulfilled without his *constantly traversing every part of the line*, and by personal inspection and observation, making himself intimately acquainted with the respective abilities, character, and disposition of every man employed under him, obtaining accurate knowledge of the varying circumstances of the traffic, and of those parts of the railway, where danger was most to be apprehended, and by the foresight which, by this means, he would be enabled to exercise to prevent the confusion and accidents with which the present system is so rife. The influence, moreover, which an officer of this description would exercise over the men, would be instantly visible in their guarded and more careful conduct, the well disposed from a hope of reward or promotion, and the bad from the fear of detection and punishment. Energy, perseverance, and tact, combined with sobriety and habits of business, would be the chief requisites in his character. It would also be essential that, in addition to his being an experienced engineer, he should be *practically conversant* with the nature and details of every man's employment, especially that of the engine-men, as a more self-important and uncontrollable set of men do not exist, if they have reason to think that those who are placed over them are not perfect masters of their craft.

The first thing to which I should suppose a person placed in this situation would direct his attention and instantly prohibit, is the very common practice of making use of either line while travelling in the same direction, a practice so obviously fraught with danger, that I am astonished how any board of directors or superintendant can, for a ment, allow it, except under the most extraordinary circumstances, and most stringent and well defined regulations, whereas, on the contrary, there appears to be no instructions whatever on this important point, nor any farther discretion exercised in the practice of it, than such as the circumstances of the case, in the opinion of those present, seem to require. Indeed, throughout the whole system, the absence of *individual* and *responsible* management is glaringly evident, and in all cases of danger and emergency, every one seems to "do that which is right in his own eyes."

Then as regards the signals, there is a red light for danger, a green light which indicates neither "danger or safety," and a white one which it would appear means anything or nothing, as the engine-man can best make out, all of which are confided without check, and almost without instructions, to ignorant, forgetful, and sometimes careless men. Can any reasonable person for a moment expect, that with a complex and ill-defined code of signals like this, railways are likely to be free from danger, or would he not rather express his astonishment, that so *few* accidents should have happened. If the road *is* perfectly clear, what necessity is there for any signal whatever, if it *is not* so, what need of more than one? Instead of all this complexity, I would at once adopt the broad and intelligible principle, that *a signal of any kind, exhibited under any circumstances*, should *always indicate danger*; and in order to carry it out, I would render it imperative on *every train* to have a light in *front* and one *behind* from sunset to sunrise, placed at such a height from the ground that persons moving about could not intercept the view. *Similar lights* should be exhibited during the same period at all the stations, placed at the *same height*, and occupying the *same relative position*, as those in the trains, so that an engine-man could not be certain, on seeing the signal, that it was not a train in his way, But the improvement to which I should be disposed to attach the most importance, and from which I should anticipate the happiest results, would be to place the whole of the station signals on a machine, which should be so far self-acting as *always, when left to itself, to indicate danger*, and to *require an effort* on the part of the attendant, before that warning could be removed; from this very simple precaution would be derived the important result, that *neglect of* or *inattention to* the signals would *insure safety*, which is sufficiently evident, as, whether danger did or did not exist, the signals would always indicate it, and cause the coming train to step until it should be removed. There are many more points connected with railway management, which are by no means brought to the greatest degree of perfection of which they are capable, but for the present, I will leave them for a future communication, should it be necessary.

I am, Sir,
Your's very respectfully,
A Railway Engineer.

November 24, 1840.

REVIEWS.

Papers on Iron and Steel. By David Mushet.

(THIRD NOTICE.)

Continuing our remarks upon the subject of iron, we may remark that the ores from which the metal is derived are distinguished by the author into two principal classes, primary iron ores and iron stones. The primary iron ores are defined to be those found in the older formations, bearing little resemblance to those in the stratified planes, and have, in Mr. Mushet's opinion, been formed by secondary agency, although they differ widely from each other in their properties. Some are distinguished as being obedient to the magnet, and others the reverse, but this property is by no means dependent upon the quantity of iron contained in the ore, but on its being in the state of protoxide, united or not with a portion of peroxyde, as ore from the *Isle of Elba* yielding 70 or 80 per cent. is but slightly affected by the magnet, while many of the Norwegian and Danish ores with only 18 to 30 per cent. of metal are highly magnetic. Mr. Mushet well defines the magnetic property as a test rather of the presence of iron than of the probable quantity to be obtained. The principal localities in England for primary iron ores are Cumberland, and Furness in Lancashire, also in the island of Islay, Muirkirk, and other places in the north, Cornwall, Devon, &c.

The Cumberland ores which present a perfectly formed crystal seem to be formed by the agency of water, an opinion which is countenanced not only by the structure but by several remarkable circumstances, water having been found in cavities of this ore, which had been transported several hundred miles. This ore is generally found, as well as that of Furness, in caverns or churns of the mountain limestone in large masses, splinty and globulated, consisting of various kidney terms called hæmatites, striated and smooth, of bluish and reddish colours. The Lancashire ore is composed of smaller masses, softer and of a more greasy appearance, but highly crystalized. Both of these ores, in the kidney variety, contain fine specimens of graphite or fossil plumbago. The ores both of Cumberland and Furness are much sought after for the purpose of mixing with poorer ores, large quantity of the Furness ore being shipped from Ulverston for South Wales. An opinion has prevailed unfavourable to the working of these ores on the spot, where both coal and limestone are at hand; no effective method of reducing them having yet been employed, although the author of the work before us has on more than one occasion given his weighty testimony as to the practicability. The Islay ore is found regularly stratified, and resembling, in point of deposition, the Norwegian and Danish ores. The strata, as described, are almost vertical, and are found imbedded in a loose ochreous earth surrounded with soil. The ore is not smelted with advantage owing to the excess of silex it contains. In different parts of Scotland, in the West Highlands, at Muirkirk, Salisbury Craggs, La Mancha, Cranston, the Ochil hills, &c., small quantities of ore have been found, but no quantity sufficient to justify the working. The chief Cornwall ores found in the granite are those of Lostwithiel, much mixed with quartz and manganese, and averaging about 48 per cent., and those of Fowey, a brown hæmatite, with 58 per cent. Those of Devon are the ores of Haytor, containing about 45 per cent. and lying in a schistose formation. We may also notice here the alluvial Minehead, in the new red sandstone, yielding 44 per cent., and at Brixham, yielding 62 per cent. The Devon and Cornwall ores are used extensively in South Wales, as also a rich hæmatite from the neighbourhood of Bristol, containing from 45 to 60 per cent. The iron of ores of the Forest of Dean are found like those of Cumberland in the carboniferous limestone; brush ore is one of the principal varieties, a hydrate, with protoxyde of iron, containing frequently from 60 to 65 per cent. of iron, the leaner ores containing a great deal of calcareous matter in the shape of spar, and so yielding only about 15 or 25 per cent. The Forest of Dean ores are the only ores worked alone, and instead of being treated with limestone, require a mixture of burnt argillaceous schist, as on account of their containing limestone, they are refractory and infusible.

We now come to the iron stones—these are commonly found in horizontal strata, subject to the same acclivity and declivity as the other stratified substances under the surface; their inclination varying according to the nature of the ground, and the disposition of the incumbent strata. They are supposed to be of aqueous origin, and are generally found imbedded in schistous clay more or less compact, which moulders away on being exposed to the atmosphere, and frequently accompany coal and limestone, in immediate contact with the coal. The ores are of two principal forms, in strata from half an inch to twelve inches thick; regularly connected strata called bands, and strata of detached stone found in distinct masses, from the size of a small shot up to a weight of several hundred pounds. The smaller masses being called in Scotland ball stones, and the larger lunkers (qy. lumpers). Band ironstone accompanying limestone is most commonly of inferior quality, its component parts being chiefly calcareous, and the quantity of iron contained being small, while ball iron stones accompanying lime are of much superior quality. The iron stones are divided by Mr. Mushet into four classes. 1. Argillaceous ironstone, which has clay for its chief component earth, and this clay comparatively pure and free from sand. 2. Calcareous ironstone, possessing lime for its chief mixture, and this lime also comparatively destitute of sand. 3. Siliceous ironstones, uniting clay and lime, and containing large proportions of silex. 4. Mixed ironstone, containing nearly an equalized mixture of clay, lime and sand. Each of these classes requires a different treatment dependent on its constituent parts, which with the quality of the fuel are the causes of the great diversity of processes which prevail in the manufacture of iron. Besides these four classes must be mentioned the Mushetstone or Blackband, a carboniferous ironstone, partaking much of the nature of coal as generally it contains carbonaceous matter enough to torrify the stone and make it fit for the furnace. Its exact geological position has not yet been determined, but is supposed by its discoverer to be in the lower part of the coal field near the millstone grit. The usual criterions by which ironstone is judged are—1, the degree of tenacity with which it adheres to the tongue after torrefaction; 2, its colour; 3, the obedience to the magnet when pulverized; 4, by depriving of its iron a given weight of the ore in the assay furnace. The first and third of these methods are peculiarly liable to error, as the degree of adhesion to the tongue will be more in proportion to the quantity and kind of clay contained in the stone, than to its real contents of iron, and the influence of the magnet as before remarked, is equally deceptive. The test by colour, although an empirical method, is one far more to be depended upon. A correct chemical analysis, however, although the surest test, is scarcely ever used, from the ignorance of the manufacturers. Mr. Mushet complains loudly and truly of the deplorable state of scientific knowledge of this class, which is as slow in acquiring instructions as in adopting improvements. He asserts that to his own knowledge the grossest mistakes have been made, and cites one case of iron ores of 30 per cent. having been sold for and smelted as ores containing 60 per cent. Detection it appears in such cases is difficult, as the charge of the furnace often consists of an association of iron ores, iron stones, and scoria from the forge and mill. Nor does the case appear to be much better among those professing some knowledge, as from want of proper instruction they are also open to gross errors. Instruction of this kind therefore seems to be a legitimate object in schools of mining and engineering, the inculcatiob of which would be of more good than all the attempts at teaching practice by theory.

A Practical Treatise on Locomotive Engines. By the COMTE DE PAMBOUR. London: J. Weale, 1840.

We feel much gratification in being enabled to recommend to the notice of those of our readers who are interested in the theory or practice of locomotive endgines, a second edition of this excellent and truly valuable work. The former edition, although conveying, in the form of experiments, more practical information relative to locomotives than any other work which has appeared on the subject, and embodying the results of those experiments in a theory, which, though not perfect, was nevertheless calculated by the soundness of the reasoning in general, to throw much light on the true theory, was still defective in several points. The resistance of the air to the motion of the trains, and that of the extra pressure of the waste steam on the back of the pistons, caused by the blast-pipe, did not enter into the evaluation of the work done by the engines. To supply these deficiencies, the author undertook, in the month of August, 1836, some experiments on the Liverpool and Manchester Railway, from the results of which he has deduced formulæ for determining those quantities which had previously been neglected in the calculation of the resistance overcome.

These experiments comprise also several other researches, such as the vaporization of boilers in different circumstances of rest and motion, the effects of different proportions between the fire-box and the tubes on the total vaporization of the engine, and on its consumption of fuel, &c.

In the first edition the loss of steam by the safety valves had been very incorrectly measured; this has suffered a material alteration in the edition now before us, but how far the new determinations are to be depended on, remains yet to be proved. It is an investigation which demands that the experiments should be conducted with the utmost nicety, and in the greatest possible variety of circumstances.

The table of experiments on the quantity of water carried over with the steam in the liquid state, differs in some respects from that which was published in our Journal for December, 1839, and to which we appended a note explaining our reasons for not putting implicit confidence in the results obtained. Two different experiments with the Star engine have been substituted in the work under consideration, for those contained in the table which was published in the Journal, and in all the other experiments which are the same as in that table, we observe that a different deduction has been made for the loss by blowing through the safety-valves during the ascent of the plane. The first of our objections is removed by the indirect statement that there was no loss by leakage during the experiments given in the table, the second in some measure by the corrections in the determination of the loss through the valves, and the last by the declaration, that the mean is only intended to be adopted approximatively for engines that have not been directly submitted to experiment in this respect. This mean has been corrected from 0·68 to 0·76.

The second chapter, which treats of the laws which regulate the mechanical action of the steam, is the same as the corresponding chapter of the "*Theory of the Steam Engine*," by the same author, which was published last year. It has been introduced here in order to save the reader the trouble of recurring to another work, besides which, it has the advantage of rendering unnecessary the purchase of that work to those who are only interested in steam engines in as much as they are applied to the purpose of locomotion on railways, and whose means may be too limited to justify such an addition to their libraries.

We are compelled, for want of time, to postpone a more particular examination of this very interesting work until next month, in the mean time assuring those of our readers who are desirous of making themselves more thoroughly acquainted with the effects of locomotive engines, that they cannot do better than possess themselves of this second edition of Comte de Pambour's Treatise; for those who were unable to obtain the first edition, will be amply recompensed for their disappointment, by the superiority of the new one, and those who possess the former, will find it almost equally necessary to purchase the latter, since it can scarcely be considered as a reproduction of the same work, but almost rather as a continuation of it, so many and important are the corrections and additions which have been introduced.

REPORT ON THE REMOVAL OF THE WEIR AT THE BROOMIELAW BRIDGE, GLASGOW.

By WILLIAM BALD, F.R.S.E., M.R.I.A., &c., Engineer of the Clyde.

To the Trustees for Improving the River Clyde and the Harbour of the City of Glasgow.

MY LORD, AND GENTLEMEN,

In conformity with the remit transmitted to me, dated the 6th instant, I have read over the Report of Captain Johnstone and Mr. Russell, Harbour Masters. It has been drawn up with great care; and from the facts therein stated, is of great value, and merits deep attention. I have no hesitation in signing their report, so far as it treats of the many advantages which would arise from the opening up the spaces between the bridges for the accommodation of the small steamers, sailing craft, &c. But there are other points, in my opinion, of vital importance, connected with this subject, which have not been mentioned in their report; and which I beg leave to lay before your lordship and the trustees.

The removal of the weir at the Broomielaw Bridge, and the deepening and clearing of the space upwards to Stockwell Bridge, containing nearly 14 acres, would give much additional tidal water; thereby increasing the currents not only through the harbour, but also to some extent in every part of the Clyde downwards; thus aiding and assisting that scouring force which acts so powerfully in freeing and keeping clear all river estuary channels from banks and shoals—the great obstacle to navigation. In the improvement of the navigation of tidal rivers, no expense or pains should be spared to increase this scouring force, arising from that uniform and constant tidal flow and run of currents ascending and descending alternately, and which are so eminently distinguished by their beneficial effects in preserving navigable channels, as compared to those violent land-floods, which, in many instances, so frequently carry down immense masses of matter, forming shoals, banks, and bars in them, extremely injurious to the navigation, and involving great expense in keeping them clear.

The removal of the Weir at the Broomielaw Bridge, and the additional receptacle for tidal water between the Bridges, would have a tendency to sweep and scour away all those impurities which are at present discharged into it by the city sewers. The removal of the weir, and the deepening and clearing away of the channel of the river, would also have the effect of lessening the miasma which arises from the present condition of the bed of the Clyde between the bridges, and would render the atmosphere of that part of the city much more pure and healthy.

It is noble and praiseworthy to erect hospitals and asylums for the relief of those who may unfortunately be afflicted with fever; but how much more advantageous would it be to cut off and destroy the sources from which that contagion arises, by the removal of all offensive matter? In this respect, the attention paid by the Dutch to many of their cities and towns, offers an excellent example to the people of other countries.

At present, the harbour of Glasgow is a receptacle, not only for a large portion of the *debris* which the Clyde sends down during floods, but it is also a reservoir for almost the whole of the matter discharged by the city sewerage. The quantity delivered into the present harbour from those two sources is immense.

The flood of last August left a deposit on the steps of the upper ferry-stairs, on the south side of the harbour, as follows:—On the upper step, reached by the flood, a depth of 2 inches; on the descending steps, 2⅛, 2⅜, 2⅝, 3⅛, 4¾, and 5 inches. The last step was about 3 feet 4 inches below ordinary high water line. It has been alleged, that the River Clyde leaves little or no deposit; but the above facts prove the fallacy of such a statement. Besides, no experienced observer could have a doubt on this subject, who has seen the extremely discoloured state of the water of the Clyde during a flood, by the quantity of alluvium held in suspension, and which is deposited in the bed and sides of the Clyde, wherever the tranquillity of the water is not disturbed by a current sufficient to carry it away;—and it should always be recollected, that, in the improvement of the navigation of a river, and the widening of a harbour through which it runs, a velocity of 3 inches per second at bottom will work on fine clay; that 6 inches per second will lift fine sand; 8 inches per second, sand as coarse as lintseed; 12 inches per second will sweep along fine gravel; 24 inches per second, gravel one inch in diameter. These established facts ought to govern the engineer as to the width which should be given to rivers, and to harbours through which rivers flow, so as to regulate the velocity of the water and prevent them from being silted up with alluvial matter, or involve a serious expenditure in keeping them clear by the artificial means of steam-dredging; therefore, no exertion or expense should be spared to increase the natural force of the scouring power, by the descending currents through river harbours and river navigations.

It may be observed, that to keep the harbour of Glasgow clear, and sufficiently deep for vessels sailing out and in, requires at least the power of two steam-dredges constantly working; the annual approximate expense of which is as follows:—

Expense of one dredging-boat per annum, including repair of wear and tear, and interest on capital, at . .	£1368	9	4
Steam-power drawing the punts	500	0	0
Discharging the material and carrying it away . .	1200	0	0
Expense of one dredging-vessel . . .	£3068	9	4

Then, the annual expense of two steam dredging-vessels will be about £6,136 18*s*. 8*d*. The area of the wide part of the harbour between Messrs. Todd and Higginbotham's mill, and the Weir at the Broomielaw Bridge. is about twenty-one acres, which requires to be operated on constantly by two steam dredging-vessels: this is nearly equal to the rate of 300*l*. per acre of harbour surface per annum.

Immediately below the Weir, and within the Port, spaces have been cleared and deepened to 10 feet below low-water line, but which have been filled up in the short period of a few months to 2 feet above it; thus filling up a space of 12 feet in height. Looking at the vast expense of keeping the harbour clear—and again, at the great inconvenience to the shipping by a reduced depth of water, arising from shoals and banks being so rapidly formed within it, so extremely detrimental to its free navigation—I am impressed with a more full conviction, that the most active and the most energetic steps should be adopted to diminish those evils as far as practicable. Therefore, the clearing away immediately of the Weir at the Broomielaw Bridge, the widening of the mouth of the Harbour, and the deepening of the River up to Stockwell Bridge, would tend partly to remove the evils here stated, because those operations would increase the tidal currents through the harbour, and equalise them at its mouth.

The matter discharged from the city sewers on the north side into the harbour, might be entirely removed by the construction of a large sewer, commencing near the Jail, and running parallel with the river down to below Barclay's Slip, where it would enter the Clyde. This sewer would receive the whole of the drainage which at present falls into the harbour from the city of Glasgow on the north, and would consequently free the port from considerable deposits which are discharged into it.

The peculiar construction of the present harbour of Glasgow, with its narrow entrance, its head barred by a stone weir extending across from side to side, over which the high tide only sometimes rises but a few inches, so that there is scarcely any perceptible tidal current upwards through it during the whole period of flood tide, until the water has reached above the top of the weir at the Broomielaw Bridge; the water sent up by the tide of flood, as well as the river water descending and falling over the weir into the harbour, remains in a quiescent state, except during the times of floods. Thus, the alluvium contained in the descending waters of the river, the silt carried in by the city sewers, and the fine particles of matter held in suspension by the tidal water flowing up—all meet in the harbour of Glasgow—at every tide, forming immense deposits, undisturbed by any tidal current for more than four hours; which fully accounts for the rapid manner in which the harbour of Glasgow silts up, and the great expense which is constantly required to keep it clear and open by steam dredging-vessels. But if that part of the river between the Broomielaw Bridge and Stockwell Bridge, were deepened, it would receive the river *debris* before it could reach the harbour, and it could be dredged up there as cheaply as any where else, and without any inconvenience to the shipping.

What can be compared to a fine navigable river flowing free and unfettered, without lock or dam, through a city, laying open, by its upper reaches, the rich mineral wealth of the interior country to the enterprise and industry of the people; while, on the other hand, the lower reaches of the river waft the ships to the ocean, that highway to all the regions of the world!

It must be manifest to any person who has observed the immense business which is carried on by small craft, on the waters of the Thames at London between the bridges, on the Seine in Paris, and on many other rivers which run through cities and towns, and the clearing away of the weir at the Broomielaw Bridge, and making the river Clyde navigable through the city, would be a work of the greatest public utility, conferring advantages of the most beneficial kind, not only on the shipping interests, but also on the whole population of Glasgow.

The Govan Railway delivers at the harbour of Glasgow annually from 60 to 65,000 tons of coal; and although this railway will, in my opinion, continue to increase in its traffic, yet I am confident that the opening of the upper navigation of the Clyde would be the means of sending down by water considerable quantities of coal and other minerals, &c. to the shipping in the harbour; and it may be observed, that the descending tidal and river currents —a power which costs nothing—would offer every facility to the transmission of coal and other articles downwards, which could be shipped at once from the barges or punts into the ships and steamers lying in the harbour, without encumbering and occupying so much of the quays, or wearing the streets by the constant cartage of such vast quantities of coal, which are not only required for exportation, but also for the supply of the numerous steamers on the Clyde, and those plying to the ports of England and Ireland. Coal-lighters, carrying about 100 tons, descend the Mersey, enter the docks of Liverpool, and supply the shipping. The facilities to river navigation which the Clyde offers, from the harbour to a considerable distance above the city, into the coal and iron districts, are extremely inviting for the carrying on of a similar traffic.

The space, as already mentioned, between the Stockwell and Broomielaw Bridges, contains an area of nearly 14 acres. The deepening and the construction of wharves within it, would be less expensive, and would afford comparatively more accommodation to the small shipping craft, than any other place which could be found anywhere within the vicinity of the harbour. The expense of the contemplated works will be nearly as follows:—

Masonry, in wharves and quay-walls, 1350 feet long .	£17,287	11	6
Deepening channel, paving, cranes, pauls, &c . .	8,047	17	0
Securing Stockwell Bridge	1,234	11	8
Total	£26,570	0	2

It may be proper to observe, that the deepening between the bridges to two feet below low water line, will not, in my opinion, disturb the foundations of the existing quay-walls in the harbour.

In concluding, it is to be hoped that the space between the Broomielaw and Stockwell Bridges, which is now waste and useless, without a raft of timber, or even a small boat, to adorn its surface, will very soon be covered with numerous classes of small vessels, presenting a scene of a busy maritime trade nearly in the middle of the city. And now that railways are about to compete with the steam-boat passenger trade, what immense advantages would it confer on the steam navigation of the river, if the weir were removed, thereby enabling the steamers sailing to all the lower parts of the Clyde, to arrive and take their departure from between the bridges, or even from the Broomielaw Bridge, which would be so extremely convenient and central to the inhabitants of the city.

BRITISH MUSEUM.—FUNEREAL MEMORIALS OF ROME.

(From the Times.)

There are, perhaps, few rooms in the British Museum whose contents deserve or attract more inquiry and observation among the generality of its visitors than the one appropriated to the funereal memorials of the Romans, and of which less account is given in the meagre synopsis of the institution; the other remains of Grecian or Egyptian antiquity which fill its halls, although possibly placed with sufficient taste and judgment, yet having no connexion with the scenery, if it may be so called, of the localities in which they are contained necessarily lose much of the effect they are calculated to produce. To the artist who contemplates the beauty and boldness of their designs, or the excellence of their execution, and takes them as models for his study, this is perhaps scarcely felt; his taste may discern their value; like the lapidary, he is equally aware of the brilliancy of the gem when it first meets his view, whether disguised by the crust that nature gave it, or set off with all the splendid adjuncts which art or study can devise. Still, even the genius of the artist may become cramped and clouded in its development from contemplating the master-pieces of antiquity isolated and unconnected from the architecture to which they appertain, and when, instead of viewing them as part of a magnificent whole, he sees them but in a state of chaotic vagrancy and isolated decay. In contemplating the minutiæ of beauty displayed in the dilapidated or even in the more perfect remains of antiquity, apart from the designs of which they form but a portion, the imagination necessarily becomes concentrated and confined by that which it contemplates, and however much the taste of the observer may be improved, and however excellent may be the work he in consequence produces, yet in his productions that sense of unity and grandeur of thought is often found wanting, which is the distinguishing feature of ancient art. To this, perhaps, may be attributed those anomalies of design which are to be seen in almost all the classic monumental sculpture of our cathedrals, and also in most of the modern architectural elevations of the Greek and Roman school. The different parts or sections of one or the other will often be found perfect, but few there are that taken as a whole will bear comparison with the edifices or monuments of antiquity. We mention this, because, in the chamber we are about to describe its architecture and decorations, with the exception of the northern side, form a perfect representation of a Roman columbarium, or place of family sepulture; the urns which are in the niches of the walls originally occupied similar positions; the sculptue of few of them possesses pretensions to excellence, and had they been placed in a room among a generality of sculptures, they probably would have caused no observation, or if any, contempt; yet in this chamber, fitted up in resemblance of those in which they were found, they acquire consequence, and well worthy are they of the observation they attract. It is the only part of the Museum in which the sculptures are in connexion with the edifice, and which, from that connexion, give a true idea of the purposes for which they were designed; in the contemplation of them the spectator, without much stretch of imagination, might almost fancy himself in a family sepulchre of ancient Rome, surrounded by the ashes of its members.

This saloon is entered from a door in the northern side of the statue gallery; it is 16 feet in length by 10 in breadth, and the height 10 feet; the roof is vaulted and divided into compartments; the colour gray. On either side, cut in the depth of the wall in lines one above the other, are niches, in which are placed the funeral urns of a family, and on the pavement on the eastern and western sides are some of greater magnitude, and also some smaller ones placed on votive altars; almost all of them are richly sculptured, and the various designs have an allusion either to the mythological dreams of the ancients, or represent some domestic scene: none of them possess that character of awful simplicity which distinguish the last receptacles of our Gothic ancestors. Beneath some of the niches are marble tablets, bearing inscriptions, and where this is the case within the thickness of the walls are enclosed earthen jars, with covers, in which the ashes of the deceased were placed. The floor is formed of Mosaic.

The niche No. 35 contains a sarcophagus, on the front of which the marriage of Cupid and Psyche is sculptured. Of this Apulcius gives the following description:—"The bridegroom in the centre is lying on a couch, Psyche '*græmio suo complexus;*' Jupiter and Juno are in the centre behind in a sitting posture, and all the gods according to their rank are standing around; a bowl of nectar is passing from one to the other. Jupiter has a particular cupbearer to himself to attend and fill. Bacchus waits on the others, while Vulcan cooks the supper; the loaves are strewed with roses and other flowers, and perfumes are scattered over all by the graces: '*Musæ voce canora personabant!*' Apollo sings to the lyre, while Venus dances in time to soft music, and the graces sing in chorus; the pipe is blown by a satyr, and Pan plays on the reed. The whole of this is a representation of the rites by which Pysche is conferred on Cupid." In this piece of sculpture the principal figures shown are Cupid and Psyche, with their immediate attendants; they are sitting on a couch, in front of which is a small tripod table, on which is a fish; around are the attendants playing on musical instruments in honour of the bride, and bearing to her wine, fruit, and presents: the companion of each of these attendants is represented as a Cupid or a Pysche, for the ancients had many Cupids and more than one Psyche. The ends of the sarcophagus are rounded, the length of it is 4 feet 6 inches, the breadth 18 inches, and the height 15; it was brought from Rome.

No. 33 is a sepulchral urn of an oblong form: three fluted spiral columns and two pilasters divide the front into four compartments, in each of which is a door ornamented on the top with pendant garlands of laurel; there are four tablets passing across the upper part, one of which has the following inscription on it:—"2 C. Magio, F., Pal. Heraclidæ V. A. xviii.;" the others are blank. The lid resembles those found on the Etruscan tombs; it is like two lids joined together lengthways; in the centre is an ornament of a rabbit feeding on fruit from a basket, on each side of which ornament is a deer, which a serpent and a dog are attacking in front and rear. The doors are supposed to be the portals of the abodes of departed spirits, they are remarkable as having their pediments of the shape generally chosen for the covers of sepulchral monuments. At the end of the urn are two spears crossed, which probably had some allusion to the youth to whom it is dedicated, who perhaps took delight in the sports of the chase, and who appears to be according to the incription—C. Magius Heraclidæ, of the Palatine tribe, the son of Quintus; it has a handsome pediment, in which are figures of dogs hunting.

The niche which is marked 21 contains an exceedingly curious cinerary urn of baked clay; the bas relief on the front represents the hero Echetles fighting at the battle of Marathon for the Greeks, his arms are a ploughshare. Upon the cover is a female figure asleep in a recumbent position; beneath her head is a pillow. Pausanias gives the following account of the circumstances of the combatant who used so singular a weapon:—"It happened in this battle (as they say) that a man dressed and having the appearance of a peasant, and armed with an agricultural weapon, should appear when the barbarians were prevailing, who when he had slain a number of them should vanish; no one knew him as an Athenian, but others said, according to the oracle, that he was a native of Echetlæum." On the border of the urn there is an inscription over the bas relief, which is slightly cut, and has not been painted. The whole of this urn is exceedingly well designed; there is great spirit shown in the attitude of the figure who has been forced down by the strength of the rustic weapon the effort it is making to rise is true to nature; the figure with the helmet has the arms of a Roman legionary, but the shields of all the combatants are Grecian; much vigour and spirit is displayed in the *melée* of the combat.

No. 13 is a sarchophagus, on which a family is represented mourning over the body of the dead; the corpse is that of a female lying on a couch, which is surrounded by the friends and relations of the deceased: they are exceedingly well grouped, and the expressions of grief are well designed. Beneath the couch are seen the sandals of the departed, as also a wreath which has been used as an ornament to the hair: a dog, probably a favourite, is also introduced, and appears as a mourner. On each side of the sarchophagus is a griffin, resting on its hind legs; the lid and plinth are modern. It formerly stood in the Caprinaca palace at Rome, and has been several times engraved. Montfaucon mentions the sculptures of this monument, as illustrating the Roman manner of lamenting the dead; the two figures close to the couch with their arms extended are alluded to in the passage of Lucan—"*Exacte ad sævas famularum brachia planetus,*" and represent a singular part of the Roman ceremony, the "*exclamatio,*" or calling aloud, on the name of the just departed, intended either to arrest or call back the flight of the soul, or to rouse the dormant spirit in case death should not actually have taken place, that the person might not be exposed to neglect or placed upon the funeral pile while any breath of life might still remain. It might be curious to inquire if the singular custom of the death wake, still so pertinaciously adhered to by the Irish peasantry, and to perform which *dacently*, as they call it, the poorest will sacrifice all they possess, and the non-performance of which is looked upon as a sacrilege committed, derived its origin from the custom of ancient, or the priestcraft of modern, Rome. At each end of the sculpture the father and mother of the deceased are standing; an old man at the extreme end holds one hand to his eyes, in the other is a funeral cake. On each side of the female are two children. Altogether there are ten figures in the group. The father is sitting on a stool and the mother in a curule-shaped chair; the head of the father is wrapped in a veil.

No. 34 is an Etruscan cinerary urn of baked clay. The bas relief in front represents the single combat of Eteccles and Polynices, who were both slain in the combat; the first from a wound in the groin, and the latter from a stab in the breast. The female figures standing by the combatants are furies; each hold a torch in one hand, while the other is extended over the antagonist encouraging and inflaming the combat; at each end, on a pilaster, is an Etruscan inscription, which is written from the right to the left in red letters. All the figures have been painted, and some of the colours yet remains. Upon the cover of the monument is a female figure asleep. The action of the whole group is excellent; the warrior who is down has lost his helmet; his hair is curled in the Etruscan fashion. His opponent is more completely armed, and the manner in which he forces the shield from his opponent, and drops his own while he stabs him to the heart, is masterly designed. The expressions on the countenance of each are different; extreme anguish in that of the fallen, and the exultation of victory in the other, are strongly defined; the figure of one of the furies is sandalled, while the other is bare. The representation of the combat as here given exactly corresponds with the account of it by the poet Statius, and it is not unlikely that he was indebted for it to these figures. It is highly probable that this contest was by no means an uncommon subject among the ancient artists. Pausanias says that the representation of it made one of the subjects which ornamented the sarchophagus in which the tyrant Cypselas, of Corinth, was deposited: in that the same author mentions that Polynices is represented as having fallen on his knee, which is the exact attitude here represented"—"*Ex Œdipi filius Polynicem* *in genu cellapsum frater Etecles urget.*" Take this sculpture as a whole, it is one of the most splendid specimens of sepulchral urn in existence.

No. 43. This is a sepulchral urn of a square form: in the centre of the front is a tablet, on which is the following inscription :—

> " Dis manibus
> " Peliæ. Philtatæ
> " M. Pilius. eucarpus
> " Convgi. B. M.
> " fecit, et sibi."

At each of the four corners is an eagle; the lid resembles a pointed roof; in the centre of the face of the urn is a bust of Pelia Philtata, and at the corners are the usual ornaments of honeysuckle flowers. The particular for which this urn is remarkable is a peculiarity in the lid, which is occasioned by a singular custom of the ancients, and sometimes practised in honour of the deceased. When the funeral rites were performed it was the custon at stated periods to visit the ashes of their friends, and to adorn their urns with flowers and garlands, and to offer sacrifices of oil and wine to their manes. In some cases these visits arose from friendship or affection, but the performance of them was often strictly ordered by the will of the deceased, and funds provided for it. In this, in order that it might with greater convenience be complied with, on the top of the lid of the urn a patera is formed, in the bowl of which is an opening through which the wine, oil, and ointments were poured upon the ashes. Propertius says—" Adfert hao unguenta mihi, sertisque sepulchrum ornabit, custos ad mea hasta sedens." Ovid in mentioning libations to the funeral urn says :—

> " Jam tamen extincto cineri sua dona ferebant,
> " Compositique nepos busta piabat avi."

On the left side of the doorway as you enter is a sepulchral urn dedicated by Flavia Dada, and by Fortunatus, a freed man of the Emperor, to the memory of her deserving husband, and his most worthy father, Admetus, a superintendent of the furniture of the Imperial Palace, and also a freed man. Above this inscription is a bas relief representing the " cœna feralis," or funeral feast. Naked to the waist is the figure of Admetus reclining on a couch; in his left hand he holds a large cup or vessel, and in his right a wreath; according to the Roman custom at feasts, his head is decorated with a garland; two children naked are sitting at his feet; behind is a female attendant, who is supporting his body; the hair of this figure is singularly bound on the front of the head in a knot. All these attendants are dwarfish in their proportions, as was frequently the case when inferior persons or slaves were represented on the ancient sculptures. These representations of the funeral feast are curious and interesting: it is impossible for us to enter into the feelings which dictated them; yet the custom of offering the funeral cake and wine at the present day may have derived its origin from it; we know not in what light the ancients regarded a future existence, but these sculptures sufficiently indicate their hopes, though they show the indistinctness of their ideas; here are the monnied dead, represented as exercising the animal functions of life; elegances are displayed to please the eye, food and wine to gratify the taste, often music to charm the ear, and garlands to perfume the air, and to these enjoyments are added the presence of their friends who are yet in existence; thus the living and the dead, the spiritual and the material world, are associated together in one common act; circumstances are represented in the history of which we can hardly participate or understand, but by which we may perceive that the ancients did entertain notions, though inaccurate and ill-defined, of a future state. The urn is ornamented at the top with garlands, which take the shape of volutes, the ends of which terminate in a rose. The præfericulum and patula are sculptured on the sides of the urn. The top has never been separated from the body; it has a large circular excavation in the middle, about seven inches and a half in diameter.

On the north side of the room, in the niche, the third as you enter, is an urn different from most of the others, and very rarely met with, being square, and of an upright shape; it is enriched by a festoon of laurel leaves. On it is this inscription in four lines :—" Vernasiæ Cycladi. Conivgi optima, vix. ann. xxviii. vitalis, Aug. 1. scrib. cv. B." The figures of a man and his wife are represented as standing beneath a portico, the roof or which resembles that of a sepulchral urn; they are in the act of joining hands; between them are the letters F. A. P. Lighted torches, placed in an upright position, form the corners of this urn, each side of which is embellished with a laurel tree; a wreath is placed on the centre of the lid, and a dolphin at each corner. The intention of the portico on the monument is in allusion to the entrance of the habitation of departed spirits, where the wife must take a long farewell of her partner. Among the Romans in the earlier times of the empire their funeral ceremonies were always performed at night, which was formerly also the custom in this country, and the torches at the corners allude to it; and even at a later date when the funerals took place in the day time, lighted ones always formed part of the accompaniment; those placed here are of the sort called " tædæ," being the semblance of a number of fine slips tied together with thongs. The dolphins relate to that superstition of the ancients which supposed that the spirits of the dead were conveyed by them across the seas to the happy abodes of the blessed. Vitalis, who by the inscription erected this monument to the memory of his beloved wife, Vernasia Cyclax, seems to have been a freed man of the Emperor, and a favourite, as he held an office similar to that of private secretary; the letters " F. A. P.," between the figures, denote that the tomb was erected by order of the Œdiles. No. 6, is a small slab let into the wall, it shows the manner in which the memory of the favoured dependents of a family were preserved; on it is this inscription—

ANNIOLENA T. F. MAXIMA	SERVILIA IRENE.

Within the wall which it faces are two ollæ or circular vases of earthenware, somewhat of the shape of the alabaster one near the centre on the south side of the room, in it were deposited the ashes of the two persons whose names are recorded on the slab in front. The lids of these vases alone are visible, which can be taken off, to allow libations to be poured which the pious affection of surviving friends might offer to the memory of the departed. Sometimes in family tombs four or more excavations were made in each niche, in general they are found sufficiently large at the top to allow the urn to be taken out, but occasionally, as in this, they are so constructed at the mouth that the space does not allow of the removal.

In the centre of the room is a mosaic pavement, which in the year 1805 was found on making some repairs under the south-western angle of the Bank of England, about 20 feet west of the westermost gate, opening into Lothbury; it was 11 feet beneath the surface, the design is handsome and well executed, but the workmanship is evidently inferior, and probably that of a native artist. The outer border is composed of pieces of brick. It is not sepulchral, nor is it connected with the other objects here: it evidently, from the cross in the centre, was made after the introduction of Christianity into the island.

On the south side, near the centre compartment of the room, placed on an altar, is a sepulchral urn without either inscription or decoration; it has handles and a cover, the shape is exceedingly elegant, the material of which it is made is the alabaster of the ancients, which is of a yellowish colour with pinkish stripes; near it there is another of the shape of a truncated cone, which has a cover and very small handles; the stripes on it are more strongly defined; the colour is the same, as is also the substance of which it is composed; the height of it is 20 inches, the diameter at the top 8½, and at the bottom 12.

The saloons containing the Elgin and Phigalian marbles have lately, after a variety of trials, been coloured in imitation of rose-coloured Egyptian porphyry, and the roof of grayish granite; time may in some degree reduce the luxuriancy and brilliancy of the colour; at present, perhaps, the rosy warmth which it throws over the apartments somewhat hurts the effect of the sculptures. The brown and dark appearance which time has given to these master-pieces of antiquity is compromised by the blooming walls by which they are surrounded and supported, their look of youthful pretention and roseate bloom but badly harmonizes with the severity of age. The monstrosities of Egypt in the adjoining halls would have been more in keeping with that mythias of colour by which their neighbours in a great degree are eclipsed and overwhelmed.

ON DRY ROT.

I was desirous of taking only a partial view of this subject, and of confining my observations to that species of Dry-rot which is common in new buildings; without encountering what is known by that name, which at one time threatened the extermination of the British Navy, and is by some attributed to the Fungi Sporotrichi, but I attempted in vain to make the distinction.*

The rot which I allude to, might be more properly called the damp-rot, or wet-rot, than the dry-rot, for it appears to arise from *confined moisture*; and the prevention as well as the cure for it, I believe, may consist in merely giving the confined moisture an opportunity to escape, by the admission of air. I do not mean to say that atmospheric air is a specific, by the administering of which rotton wood can be made sound; but I do mean to express my belief, that the introduction of air, even in small quantities, will effectually arrest the destructive progress of the dry-rot.

I will mention two instances now existing of this dry-rot in two new churches, namely, that of Trinity Church, Oswestry, and the New Church at Aberystwith. The former is built of rubble-stone of the neighbourhood, from Sweeney Mountain, which is a free-stone, with a large proportion of mortar; the latter is built of rubble-stone of that neighbourhood, which is of a slaty quality, with a large proportion also of mortar. In both these cases the ends of the pews are closely fitted with framed panels of deal upon damp walls, good oak floors in the former, and I think in the latter also, and risers of deal under the pew doors. The effects of this dry-rot have become very conspicuous in both instances, by an extensive destruction of the wood work, against the walls, and under the doors of the pews: upon removing the panels &c., it was found that a parasitic fungus has made extensive ramifications, and the deal is very much decayed, but the oak has as yet suffered comparatively little injury. I believe, that if a perforated plate containing apertures equal to three or four square inches had been inserted in the upper panel, fixed to the wall in each pew, and the like under each door, the mischief would not have happened; and that if these means of ventilation were resorted to now, they would stop the progress of the dry-rot. But I do not know any thing more certain to produce the dry-rot than what I have just noticed, and consequently nothing could put any expedient for the prevention or cure of the evil to a severer test than to have thus impounded the moisture. A pretty little gothic pattern, weighing three-quarters of a pound, has been prepared and partially put up in Trinity Church, for ventilating the parts affected with dry-rot.

---

* The following Fungi are considered as the cause of dry-rot :—Boletus lachrymans, Merulius lachrymans, Polyporus destructor, and the genus Sprorotrichum.

The growth of the parasitic plant, and the decay of the wood coming into contact with it, seeming to be in a great degree contemporaneous, I am not prepared to say which is the cause, and which is the effect of the other; but I think that the growth of the plant takes precedence of the destruction of the wood.

I shall relate two or three facts which have come within my knowledge, because they strengthen my conviction as to the most effectual means for the prevention and cure of the dry-rot.

The usual manner of preparing the walls of a house for skirting-boards, and fixing them, is likely to produce the dry-rot, as thus:—a coat of mortar mixed with pounded glass fills up very closely the space behind the skirting-boards, to prevent mice from having a run there, and a moulded cap of wood is rabbeted and put up for receiving the plain board: on the floor is sprigged down a rib of wood, of about one inch square, for the whole side of a room, without any intermission, and the skirting-board is then scribed and closely fitted to the floor, &c.

In a new house the walls and the plaister may not be perfectly dry, and the same mischief which has been described in the pews of a church is likely to occur, and does so continually, in the decay of the skirting-boards, particularly on the ground floor; but I think that it happens less frequently when there are arched cellars below, which may carry off some of the moisture. A little of the water in washing the floor, the skirting-board being in a dry state, will find its way behind it, and increase its liability to decay, by impounding a little more moisture.

I have observed this to take place to some extent in fifteen or twenty years after a house has been built, but not perceived till the damage was considerable, because the paint will conceal it. In replacing the skirting-board instead of a continuous rib of wood sprigged on the floor, I have taken pieces of a foot or foot and half in length, leaving a vacant space of two or three inches between them, and not fitting the skirting-boards very closely to the floor, so that a small circulation of air may be preserved; and no decay has occurred in a similar period, at least I can answer for a term of thirty-five years from the erection of the building.

When a new mansion house is to be built, it often happens that a certain quantity of sound timber from an old house is to be made use of, in the shape of beams, joists, &c., and the old beams and joists are apt to be immediately applied to the ground floor, which is a great mistake. An instance of this having occurred within my knowledge, I must give a minute account of facts and consequences in order to bring them to bear on the points which are under consideration.

The front of the house faces the west, and consists of two principal rooms extending length-ways to the right and left of an entrance room, the floors being three steps above the ground; and I am pretty sure that the joists, if not the beams also, were of old timber: the boarded floors were of the best Baltic oak, prepared and finished in the most careful manner. Beneath these front rooms there are no cellars, but arched cellars extend under all the back rooms, which appear to have prevented the evil that I am about to describe as having occurred in the floors of the two principal rooms.

In the course of twenty or twenty-five years from the building of the house, the deal skirting-boards on the outward walls were found to have decayed, particularly on the west, and the floor sunk nearly an inch in some places from the skirting-boards. It was evident that the joists had failed at their insertion into the outward walls. The floor was then taken up for an opening sufficient to admit a man with a lighted candle, who crawled on his hands and knees under the floor, to ascertain the extent of the mischief: the parasitic plant or the dry-rot had got so great a footing, that it became a question whether the whole of the two floors ought not to have been taken up; but it was at length resolved to try the effect of a less expensive operation, which at the present time, after a lapse of ten or fifteen years, seems to have answered perfectly well. Several new oak joists were placed crossways beneath those which had partially failed, and as nearly as conveniently might be to the decayed ends of those joists which had wholly or in part lost their holds upon the outward walls, propping the new joists with bricks, slates, and stones; and the skirting-boards were then replaced in the manner before described.

But the thing on which the greatest reliance is to be placed was the preparation to be made for the circulation of air beneath the floors: plates of iron were cast three inches square, perforated with many holes of a quarter of an inch diameter, four of these plates were applied to each of the two rooms, two distantly from each other, at the two outward sides of the walls, below the floors, and two on either side of the fire-places in the floors, whereby a continual circulation of air was established, and has ever since been kept up: and I conceive that the progress of the dry-rot is stopt, while the supply of air required for the fires is materially assisted.

The disagreeable mouldy smell of dampness accompanying the dry-rot was evident enough as soon as the floor was opened, and continued to be less and less perceptible for months, or perhaps years, through the small grates; but those near the fire-places were covered occasionally: the grates had better have been made of brass one-third or one-fourth of an inch thick. I shall bring forward only one more instance, to prove that confined moisture is the cause of the dry-rot, and I must again be very minute, that I may be the better able to support my suggestions when I attempt to apply them to general purposes.

About the year 1820, or a little later, there was occasion to build a new sitting-room at a farm-house, and the site fixed upon was over a cellar, then roofed as a shed or lean-to: the new floor was approached by four steps out of the kitchen, the walls were built of rubble-stone eighteen inches thick, the size of the room is 14 ft. 9 in. by 11 ft. 6 in.—the floor over a slope, and from four to two feet above the ground, while a grate of seven inches square ventilates the cellar from the north.

The object of this is to show in how short a time the new floor was totally destroyed by the dry-rot, without in any way accounting for it, but from the floor itself. The joists were cut out of sound poplar, probably the upper or inferior parts of trees, and between the joists were nailed ribs of wood to support short pieces of boards for grouting in the usual manner of counter-ceiling, the floor was neatly laid with inch poplar boards well seasoned, planed, and of the best quality.

In the course of a few months, I believe, the floor joists, boards, &c. were entirely decayed, excepting a few feet near to the door out of the kitchen, which were only partially so. Although, I believe, that the decay was very rapid, I can only assert from recollection of some other particular occurrences, that in the course of three years the room was built, the one floor laid, that floor decayed, and a new floor put up, which is perfectly sound at the present time, after a lapse of more than 17 years.

The present floor is made of oak beams and joists, and very good poplar boards, without any ceiling or laths and plaister under them.

The way I would account for this extraordinary instance of dry-rot is, that the walls were damp when the first-mentioned floor was laid, and that the counter-ceiling was very damp, that the boards were dry and closely fitted, that a fire was rarely (if ever) used in this room, and that the progress of the dry-rot was extremely swift, as it would be in any case under similar circumstances of confined moisture.

I may mention chamber floors of poplar boards at the present time, over a considerable extent of kitchen and other offices, which have been laid down for thirty-five years, and are as sound now as they ever were: although I have seen poplar boards used as window shelves in inferior apartments, and in some other ways, which have gone into complete decay, grub-eaten or otherwise, in the course of a few years.

The reader who may have waded through the details of facts, which I have thought necessary for my purpose, may wish to have the conclusions drawn from them recapitulated in a few short sentences, as thus:—That wherever joiner's work is to be fitted to newly-built walls, there should be means taken for the circulation of a little air. That the beams and joists used for the ground floor of a house should be of British oak, larch, or best foreign deal. That the ends of beams or joists inserted into the outward walls of a new house, on the ground floor, should be cased with sheet lead, zinc, or cast iron, all impervious to moisture, but not too tightly fitted, for fear of the sap's producing confined moisture; or they might be secured at their ends with cases made on purpose of fire-brick clay, or other clay impervious to moisture. I have used cast-iron sockets and fire-brick cases very satisfectorily. That the wooden ribs upon which the lower edges of the skirting boards are to be nailed should not be in continued lengths, without some intermission. That wherever floors are laid with stone bricks, or slate flags, the skirtings should be made of slate-flags from three-quarters of an inch to one inch in thickness, with one sawed edge. That in servants' halls and other offices, where it may be desirable for the skirting or dado to extend to the height of three feet or more, slate-flags of three-quarters of an inch or one inch thick, might very properly be preferred to wood, but capped with a grooved ledge of wood; these slate-flags being worth only about 9*d.* the square yard.

Many of the particulars respecting the rooms which have been affected with dry-rot may, as I have observed before, appear trivial, or even ludicrous; but when it is recollected that we have been alluding to facts that occurred fifteen or twenty years ago, and which engaged attention only for the moment, I wish to state what is still to be seen; and more particularly to show, that there was nothing in the position nor dimensions of the room last-mentioned, neither door, window, chimney, nor any other circumstance, whereby such an effect of dry-rot could have been produced or promoted, excepting only by the *confined moisture*, and to which alone the dry-rot is to be attributed.

A simple remedy for any grievance is sometimes unpopular, and you may be advised to poison unwelcome vegetation as you would rats, without considering that poison, like gun-powder or steam, is not a thing to be played with.[*] Is it not more reasonable to trace a mischief, if possible, to its cause, and by removing or counteracting the cause, endeavour to prevent or arrest the progress of the effect? Suppose that a ship may be liable to dry-rot, from confined moisture and the sap (juice) of unseasoned timber,[†] the natural remedy would be to give a change and circulation to the stagnant atmosphere by ventilation: I see no reason why dry-rot in a ship might not be prevented or arrested by a sufficient number of small grates, which have been used so successfully about the floors of the two rooms as above described.—*Salopian Journal.*

ON THE ECONOMY OF RAISING WATER FROM COAL MINES ON THE CORNISH PRINCIPLE.

At the annual meeting of the members of the Manchester Geological Society, held at their rooms, on Thursday, the 29th October, Mr. Fairbairn read a communication "On the Economy of raising Water from Coal Mines on the Cornish Principle." In introducing his paper to the meeting, Mr. Fairbairn, after explaining the sections of the engine and pumps made by him for some Belgian coal mines, said, that the improvements introduced of late years into the Cornish engines, were of so important a nature as to be highly worthy the attention of the miners of this district. They had not, till very lately, the slightest conception of the great saving effected by the performance of the Cornish engines, which was so great that the pressure of steam in the cylinder, which would amount to 7,500 lb. per square inch, would raise nearly double the amount of any in the neighbourhood, chiefly from the advantages of the expansive principle adopted in the Cornish engine. Mr. Fairbairn then proceeded with his paper, of which the following is an abstract:—

---

[*] Corrosive sublimate is the only known specific, mineral or vegetable, for preventing the growth of the dry-rot fungi, and which, I believe, has formed the basis of Mr. Kyan's patent.

[†] Oak would require less seasoning, and be much fitter for use, if it were cut down in winter instead of in spring. I recollect, some fifteen or twenty years ago, observing a sound oak plank in the gable end of a house which was under repair; some of the sap (alburnum) and bark was still on the oak, and very slightly grub-eaten, although it might have been in the building an hundred years, perhaps, or more, on the inside of an outward wall, nogged with bricks, and never had been covered with plaister nor colour of any sort.

"The steam engine performs so important a part in almost all the transactions of man, where great power is required, that the progressive improvements of this mighty agent, indispensable to the miner, must be regarded with interest by all. By the geologist its improvement will be looked at with additional pleasure, since by its means he is enabled to explore the earth to a much greater depth than he otherwise could have done. For this reason, I have thought it might not be out of place to give here some account of the progress of the steam engine during the last 120 years, mentioning the dates of its leading improvements.

"From the time of Savery and Newcomen, in 1707, to that of Beighton, in 1717, it remained stationary, till 1769, when Smeaton introduced considerable improvements upon atmospheric engines, the average duty from fifteen of which amounted to 5,590,000 lbs., lifted one foot high by a bushel of coal.[*] These improvements continued; and the duty, in 1772, was raised to 9,450,000 lbs.

"Mr. Watt's improvements commenced in 1776, when the average duty was declared at 21,600,000—more than double that of Smeaton's; and, during the years 1778-9, it was still further increased.

"In 1779, and from that to 1788, Mr. Watt introduced the improvement of working steam expansively, which raised the duty to 26,600,000. From 1788 to 1812, few, if any improvements were made in the Cornish engines; and, provided we except the plunger pole, which was introduced about this time, I question whether the Cornish engineers and miners did not retrograde rather than advance during a period of twenty-four years.

"In 1814 considerable advances were made, which raised the duty to 32,000,000 lbs. During that year, Woolf's engine, with two cylinders, was introduced, which again advanced the duty to 54,000,000 lbs.

"Mr. Woolf, above all others, did most for the Cornish engines, by showing the advantages peculiar to high pressure steam, and prepared for subsequent improvements, which led to the present effective system of expansive working.

"During a period of six years, from 1814 to 1820, Woolf's double cylinder engine maintained its superiority, and gave a higher duty than any other.

"Woolf's engine, in process of time, gave way to others of a better construction. They were introduced by Captain Samuel Grose, whose experiments upon the generation and preservation of heat led to great improvements, and ultimately established a new era in the history of the Cornish engine.

"In 1826, Captain Grose's engine, at Wheal Hope, attained a duty of 62,000,000 lbs.; and, in July of the following year, one of Mr. Woolf's single cylinder engines performed the unprecedented duty of 67 million.

"From this time Captain Grose's improvements were appreciated, and generally introduced; they led to a still greater advance in the duty, which this year reached as high as 87 million lbs.

"Messrs. Lean and Brothers report the duty of a few of the Cornish engines at this time as follow:—

	Millions lbs.
Wheal Towan Engine	87·0
Wheal Hope	74·8
Consols	67·6
Binner Downs	63·5
Consols	61·7
Consols	61·3
Wheal Vor	61·1
Wheal Towan, (Druce's)	59·4
Consols	58·4
Poldice	57·8
Wheal Vor	51·9

These give a mean duty of sixty-four millions of pounds.

"Nothing remarkable took place till 1834, when the duty was raised to 90 millions lbs. Since then, it has continued to increase in the ratio of 90, 100, and 110 millions: and during the last meeting of the British Association, at Glasgow, Mr. Taylor reported the present duty at the unequalled performance of 123, 300,593.

"Having briefly stated the progressive improvements that have taken place in the Cornish system of pumping, I would now direct the attention of the society to the important results which these improvements have produced.

"The quantity of coals consumed by all the engines working at the mines in Cornwall, in the year 1835, was, according to Messrs. Lean and Brothers, 1,669,421 bushels. Now, if we compare this with the number of bushels which would have been consumed to produce the same power in 1814, we should have, for the consumption at that period, 4,049,878 bushels, making a saving of 99,185 tons; which taken at 17*s.* per ton, (the price of coal in Cornwall,) we have the enormous saving of £84,308.

"From the above facts, it cannot be doubted, that the improvements in steam engines, and the consequent saving thus effected in the consumption of fuel, are matters of deep importance. Even in districts where coal is cheap, it is a consideration well worthy of attention; and we are assured by geologists, that the coal of this country, although abundant, will not last for ever."

In the course of a very interesting discussion which followed the reading of the paper, Mr. Fairbairn said, he might mention that so great was the saving from the improved system of working the Cornish engines, that it was not improbable that, in this neighbourhood, we might come back to the old system of power for factories. If the duty performed by the Cornish engine was so much more than that of any factory engine in this district, it might be desirable to have a Cornish engine connected with a water-wheel to drive mill machinery.[*]

Mr. Boothman.—Why not apply it to rotatory motion?—Mr. Fairbairn said, that it would not apply to any thing where the force required was constant. The value of the thing lay in overcoming the inertia of matter. The Cornish engine first raised a weight, and then, by the descent of that weight, it raised the water. That was the whole secret of the Cornish engines.

Mr. P. Clare asked if Mr. Fairbairn had made a calculation of the effective force of the factory engines in this neighbourhood, so as to afford a comparison as to the combustion of coal by them with that of the Cornish engines?—Mr. Fairbairn said, he had done so. The consumption of fuel in our best condensing engines here was 10 lbs. to 12 lbs. per horse power per hour, while the consumption of fuel by the best Cornish engines was only 2½ lbs. per horse power per hour. In other words, we consume four times more coal than the Cornish engines in producing the same effect. The circumstance was most extraordinary; but the facts were before the meeting. The returns of the duty performed were regularly registered in Cornwall, and published monthly, so that any gentleman might see them, in reference to any period; and it would be found, that the performance of the best Cornish engines (for he did not, in reference to this question, speak of the average duty) did not exceed a consumption of 2½ lbs. of coal per horse power per hour.

A Member asked whether there was not some doubt as to the accuracy of the calculations of the duty performed by the Cornish engines, and as to the mode of estimating them?—Mr. Fairbairn said, that the calculations were made upon the area of the bucket and the length of the stroke. He was aware that doubts had been expressed as to the accuracy of the calculations; but they were backed by such authorities, and the returns were so numerous and regular, that he thought their general accuracy could not well be doubted.—The Member observed, that a small quantity of air coming up the pumps would make a difference.—Mr. Fairbairn: No doubt; but still the engine has to lift this great weight of all the pumps and iron work, and the plungers, which must be lifted by the force of steam. He had a return from Mr. Wicksteed, of the East London Water Works, which was not a pit at all; but the Cornish engine there was used to raise water for the supply of the eastern part of London—which return gave a duty of 118,552,475 lbs. raised one foot high; the consumption of fuel being 2·4 lbs. of coal per horse power per hour. Of course he did not speak of the duty performed by these Cornish engines from his own knowledge, but he had every reason to believe the returns substantially correct.—The Member said, he believed some doubts had been repeatedly thrown on the method of calculation.—Mr. Fairbairn said, that some years ago he had been present at a discussion on the subject in the Society of Civil Engineers, when great doubts were expressed, but further documents were brought forward to prove the accuracy of the calculations. However, taking the consumption of fuel by the Cornish engines to be 3 lbs. per horse power per hour, that was a very great difference, as compared with our factory engines.

Mr. Eaton Hodgkinson thought there had undoubtedly been great improvements made in the Cornish engines, chiefly the result of the adoption of the expansion of steam, which they had not been used to any great extent in this neighbourhood, at least till very recently. Whether the returns were quite accurate or not, no one could doubt that the improvements were immense. He thought the plan of making the engine to lift the pump-rods only, and then the descent of the pump-rods lifting up the water, seemed to be a considerable improvement in adaptation. Again, whether Mr. Woolf's plan of the expansion of steam, or that of Mr. Watt, expanding it in the same cylinder, and cutting it off when at a distance of one-fourth or one-fifth down, were adopted, (and it was a question as to which plan was the best,) in both cases there was a great improvement upon former methods. These improvements had a strong bearing upon geology, for were it not for these engines, they could not investigate the strata in mines, for the water would drive them out or drown them. These engines, by draining lakes, might enable the geologist to obtain a great deal of information he must otherwise be without.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

Tenth Meeting.—*September*, 1840.

(From the Athenæum.)

Section G.—Mechanical Science.

Mr. James Milne gave an account of an instrument termed *a Gas Regulator*, of his invention, by means of which the length of the flame is equalized, notwithstanding the variations of pressure that occur, and a considerable saving in the consumption of gas is effected.

Mr. Coles *on Railway Carriages.*—Mr. Coles proposes to introduce friction wheels; and that, excepting the first and last carriage in the train, the carriages should run on *two* wheels. He also proposes a step-rail at the curves or bends.

"*On the Turbine Water-wheel.*" By Prof. Gordon.

The fundamental principle upon which the construction of the *Turbine-Fourneyron* is based, is that by which the maximum of useful effect is obtained from a given fall of water, depending on the relative velocity of the water and its recipient, which ought to be such that the water enters the wheel without shock, and quits it again without velocity. A notion of its construction may readily be formed, by supposing an ordinary water-wheel laid on its side, the water being made to enter from the interior of the wheel by the inner circumference of the crown, flowing along the buckets, and escaping at the outer circumference. Then centrifugal force becomes a substitute for the of gravity. A drawing was here exhibited of a Turbine of about 5 horse force power, the fall being 3 feet, and the expenditure of water 20 cubic feet per second. It was explained that the Turbine consists essentially of—1. A reservoir, the bottom of which is divided into radial compartments by curved plates, serving to guide the water to take a particular direction of efflux. 2. A circular sluice, capable of nicety of adjustment. 3. The wheel with curved buckets, on to which, when the sluice was raised, the water entered at every point of the inner circumference, and flowing along the buckets, escaped at every point of the outer circumference. This latter is a characteristic feature in the Turbines of Fourneyron. Reference was made to the principal Turbines erected in France and Germany,—particularly to that at Inval, near Gisors, and those at Müllbach and Moussay, as illustrative of their use for falls varying from 9 inches to 10 feet. And, again, to those at St. Blasier, in the Black Forest, as instances of high falls,—the one being 70½ feet, the other 345 feet; the one expending 5 cubic feet per second, the other 1 cubic foot per second; the one being 56 horse power, the other very nearly 60 horse power; the one giving an efficiency of upwards of 70, the other of upwards of 80 per cent. of the theoretical effect. A drawing of the latter was exhibited—full size. It is 14½ inches diameter. Its extreme depth or *breast* is ·225 inch, or less than ¼. It makes 2,200 to 2,300 revolutions per minute. It serves a factory, in which are 8,000 water spindles, 34 fine and 36 coarse carding-engines, 2 cleansers, and other accessories. The conclusions drawn by Morier from his experiments on these wheels with the Break dynamometer, or friction strap, are these:—1. That Turbines are with equal advantage applicable for high and for low falls. 2. That their net useful effect equals 70 to 78 per cent. of the theoretical effect of the power. 3. That they may work at speeds varying from

---

[*] Duty is a term first used by Mr. Watt for ascertaining the comparative merits of steam engines. In Cornwall it is used for determining the number of millions of pounds of water lifted one foot high by a bushel of coal, (94 lbs.;) the time of lifting it not being considered.

[*] See Mr. Wicksteed's report in the Journal for January last, page 7.—Ed. C. E. and A. Journal.

$$n=\frac{3{\cdot}3\ \mathrm{V}}{\mathrm{R}} \text{ to } n=\frac{5{\cdot}6\ \mathrm{V}}{\mathrm{R}}$$

Where n = number of revolutions; V = velocity due to fall; R = extreme radius. The useful effect still not differing notably from the maximum. 4. That they work at very considerable depths under water, the relation of useful to theoretical effect not being thereby much diminished.

Mr. Smith (Deanstown) said, there was much in the principle for very high and very low falls, and for varying falls. The principle had been long applied in Perthshire, but in that part of the country a great velocity is obtained at a great expenditure of power.—Prof. Gordon stated, that for all falls above 50 and below 10 feet, the Turbine is to be preferred.—Mr. Fairbairn: The common water-wheel at Gisors, in France, was made by himself and comparative trials were made with it against the Turbine. Mr. Fairbairn was quite satisfied, by Arago's experiments, and otherwise, that the Turbine is a very important machine, and gives a result of 70 to 75 per cent. of the theoretical effect.—Mr. Smith proposed, that as he had peculiar facilities for experimenting on the subject, he, along with Prof. Gordon and Mr. Fairbairn, should investigate the comparative merits of the Turbine and other water-wheels before the next meeting of the Association.

"*On producing True Planes or Surfaces on Metals.*" By Mr. Jos. Whitworth.

Surface plates were exhibited, intended to illustrate the proper mode of preparing surfaces where great accuracy is required. If one be put upon the other, it will float, until by its weight it has excluded some of the air, when they will adhere together with considerable force. These surfaces were got up without grinding. The only operations performed upon them were those of planing, filing, and scraping. Practically, the excellence of a surface consists in the number and equal distribution of the bearing points; the more numerous these are, and the nearer together, the more perfect is their action. But, if a ground surface be carefully examined, the bearing points will be generally found lying together in irregular masses, with extensive cavities intervening. The cause of this irregularity is evident in the unmanageable nature of the process. The action of the grinding powder is under no control. There are no means for securing its equal diffusion, or for modifying its application with reference to the particular condition of different parts of the surface; while the practical result is, that the mechanic neglects the proper use of the file, knowing that grinding will follow, to efface all evidence either of care or neglect. In various departments of the arts and manufactures, the want of improvement in this respect is already felt. The valves of steam engines, for example, the tables of printing presses, stereotype plates, slides of all kinds, require a degree of truth much superior to that they now possess, for want of which there is great waste constantly accruing in time, in steam power, in wear and tear, and, above all, in skill misapplied. The improvements so much to be desired will follow upon the discontinuence of grinding, The surface plate and the scraping tool will then come into vogue, and a new field will be opened to the skill of the mechanic. Supposing him to be provided with a true surface plate, he will find no difficulty, after a little practice, in bringing up his work to the required nicety. For this purpose he will find it advantageous to employ a scraping tool made from a three-sided file, and carefully sharpened on a Turkey stone, the use of which must be frequently repeated. A light colouring matter, such as red chalk and oil, being spread over the surface plate, and the work in hand applied thereto, friction will cause the prominent places to be marked, which will instruct the experienced mechanic where and how to operate to the greatest advantage.

Mr. Scott Russell presented the Report of the Committee *On the Form of Vessels:* the members of this Committee were Sir John Robison, Mr. Smith, (Jordan Hill), and himself.

Since their appointment by the Association, the Committee had been constantly engaged in carrying out the various investigations committed to their charge; and it had been their earnest desire to discharge their duties in such a manner as conclusively to settle the many important practical questions in naval architecture which were matters of uncertainty and dispute, especially in reference to steam navigation. The importance of precise knowledge in constructing a mercantile navy, ships of war, and steam vessels, was reckoned so great, that in almost all civilized kingdoms experiments had been undertaken at the national expense, and Italy, Spain, Sweden, and France had obtained by those means a very superior knowledge of the principles of the construction of ships. In this country the labours of individuals had supplied the only experiments of this nature; and it was matter of regret, that these were not of such a description as to furnish the ship-builder with any certain foundation for rules of art. The new demand upon the invention of the naval architect by the introduction of steam power, had also contributed much to augment the disparity which already subsisted between the data of experimental hydrodynamics and the demands of the practical builder of ships. It had also been thought not improbable, that certain singular phenomena in hydrodynamics, recently discovered, might considerably modify the views hitherto entertained of the nature of fluid resistance; and the Association had, therefore, resolved on the appointment of this Committee, for the purpose of giving this subject a thorough and searching examination. The first subject of concern with the Committee, was the mechanism by which to conduct experiments on a scale sufficiently large to render the results of practical value, and at the same time sufficiently manageable to free the experiments, as far as possible, from elements foreign to the immediate subject of examination. It was desirable to obtain, for experiment, a force capable of moving the vessels subjected to experiment, through the water with an uniform force and velocity capable of being continued for a considerable interval of time over a considerable length of space. All the forms of apparatus hitherto adopted for the purpose of experiment, were examined with the view of adopting the best. None of them appeared fully to answer the end in view, and it became necessary to invent another and better apparatus for giving motion to the vessels. This had been found: a simple contrivance of Mr. Russell's had been adopted, by which a force, perfectly uniform, could be applied without inconvenience throughout any given space, free from the usual errors of friction, rigidity, &c., which had become interwoven with the results of former experiments. This apparatus he regarded as an engine of experiment so important to the future acquisition of knowledge of the resistance of fluids, that he was desirous to communicate it to the distinguished men around him taking an interest in the subject, in order that if it met their approbation, they might avail themselves of it in future investigation. He then proceeded to give a description, with illustrative drawings, of an apparatus by which experiments were made of from a small scale up to 100 feet in length, over a sheet of water from 100 feet to half a mile or a mile in length. For each scale of experiment, strings, cords, and ropes of various thickness were employed; and for the most delicate experiments, a slender Indian fibre, brought home by Sir John Robison, had been found most useful. Two chronometers by Robert, of Paris, also brought over by Sir John Robison, were employed with great advantage, as observations were obtained which could be depended on within two-tenth parts of a second. The next point to be determined was, the general method of conducting the experimental inquiry, so as to elicit the most valuable truths, and those most apposite to practical art. For this purpose the most eminent ship-builders were consulted, as to the points upon which they most wanted information, and were requested to point out what were the forms of vessel which they would wish to have tried. More than 100 models of vessels of various sizes, from 30 inches to 25 feet in length, had been constructed. These were drawn through the water with various velocities, and at different degrees of immersion, so as to determine the resistance of all the various forms that might be adopted in practice, and enable the builder to adopt the form best suited to his purpose. A large pile of papers, laid on the table, contained the results of the experiments, which were still continued. Of these experiments, different series were conducted with very various objects. One class regarded the transverse sections of ships; another the water-lines of the bow; another the water-lines of the stern; another the form of ribband-line and of buttock-line; another class, the place of greatest breadth, and so on. From these experiments it resulted that vessels might be made fuller than usual at some points and finer in others, with great advantage. A peculiar class of lines, called by Mr. Russell "wave lines," appeared best adapted for high velocities both in smooth water and at sea. It also appeared, that the manner in which the particles were displaced by a moving body, and replaced themselves after its passage, was very different from what was generally supposed. There also appeared to be three different conditions of fluid motion and resistance, accompanied with distinct characteristic phenomena: motion slower than that of the wave—motion on the wave—motion on wings of water. The last occurred only at very high velocities, and when two high and beautiful films of water spread themselves in the air, and carried the boat as on gossamer wings along the snrface of the water. Mr. Russell concluded the report, by stating, that the experiments would soon be published, and submitted to the examination of those interested in the subject, in a form better adapted to use than that of verbal description. He hoped it would be found that their experiments had gone far to fill up one of the great desiderata of practical science.

Sir John Robison stated, that the whole merit of imagining and conducting the experiments belonged to Mr. Russell.—Mr. Arch. Smith made some observations, disputing the mathematical accuracy of one of the illustrations used by Mr. Russell.—Mr. Russell explained that the physical effect differed in this instance from the mathematical theory.—The Rev. Mr. Brodie had arrived, by calculation, at nearly the same results as Mr. Russell had by experiment. Mr. Brodie hoped Mr. Russell would ditect his attention to the phenomena at very high velocities, such as from 25 to 30 miles an hour. Mr. Brodie's calculations have led to such curious conclusions, as to make him suspect some mistake: he was, therefore, anxious that Mr. Russell should prove their accuracy by his delicate experiments.

"*On the Economy of Railways in respect of Gradients.*" By Mr. Vignoles.

Mr. Vignoles stated that this was another subject, in addition to the former one on timber bridges, selected from a general work on the Principles and Economy of Railways, which he was preparing for publication. Looking to the great cost of railways, he had turned his attention to a comparison of the result of the working of railways, with the price paid for various degrees of perfection. He disclaimed asserting that sharp curves or steep gradients were preferable to straight and level lines, but he would endeavour to show that good practicable lines might be and had been constructed, on which trains sufficient for the traffic and public accommodation could and did move at the same, or nearly the same velocities, and with little, if any, additional expense. On an average, the hitherto ascertained cost of the principal lines might be divided thus:—

Land	10	per cent.
Stations and carrying establishment......	20	"
Management..............................	10	"
Iron	10	"
Works of construction proper	50	"
	100	

though, of course, these items differed considerably in various railways, but in general it might be said that the works of construction constituted one-half of the whole first cost. He left out, on the present occasion, all consideration of the saving of any of the items, except as to the works of construction; though it would not be difficult to show a reduction on these, to the extent of at least one-half. Mr. Vignoles stated that he had analyzed railway expenses of working, and had reduced them to a mileage,—that is, the average expense per mile, per train, as deduced from several years' experience, and observations of various railways under different circumstances, and with greatly different gradients, some of which lines were enumerated. The result on passenger and light traffic lines was, that the total deductions for expenditure from gross receipts was 3*s.* per mile per train; 2*s.* 6*d.* being the least, and 3*s.* 4*d.* the highest; and that this average seemed to hold good, *irrespective of gradients or curves.* Particular lines might, from local circumstances, differ in detail, but he was satisfied that the following detail was a fair average approximation:—

	s.	*d.*
Daily cost of locomotive power and repairs	1	6
Annual depreciation, sinking fund, and interest on stock, tools, shops, and establishment	0	6
Daily and annual cost in carriage department	0	4
Government duty, office expenses, police, clerks, guards, management, and maintenance of railway	0	8
	3	0

It was not found practicable to distinguish the additional expense, if any, arising from curves or gradients; but as three-fourths of railway expenses were quite independent of these curves, such addition must be small; especially as, on the North Union Railway, a line which had 5 miles out of 22 in the gradients of 1 in 100, or nearly 53 feet per mile, the total expenses were less than on the Grand Junction Railway, and several other lines. Mr. Vignoles then proceeded to illustrate, by diagrams, the mode in which the economy might be made in the works of construction, on what he called the *first system*, by the occasional introduction of inclines of 50 and even 60 feet per mile, if not of too great a length; and again, on the *second systeem*, by introducing entire series of severe gradients, such as those of 30, 35, and 40 feet. On the first system, he had executed the North Union Railway; and had also thus designed all the government railways to the south and west of England. On the second system was the Bolton and Manchester Railway, by the late Mr. Nimmo, Mr. Macneill's government railway lines to the north districts of Ireland; and that engineer had lately altered the Dublin and Kilkenny, and the Dublin and Drogheda Railways, from better but more expensive gradients, to those on the second system; and Mr. Vignoles was about to apply it to the Dublin and Kingstown Railway; and he had set out the whole extent of the Sheffield and Manchester Railway, for 40 miles, on an average gradient of nearly 40 feet per mile, mixed with occasional inclinations of 1 in 100, and with curves of one-third mile radius. That work was now under execution by Mr. Locke, who had succeeded Mr. Vignoles an engineer, and who fully concurred in the general principles,—which, as also the details, and the introduction of timber viaducts on a large scale for economy, Mr. Nicholas Wood approved. Mr. Gibbs had also adopted the same system on the first ten miles eastward of the Newcastle and Carlisle Railway. Mr. Vignoles went on to state, that, on either one or both of these systems, introduced as might be considered most advantageous by the directing engineer, lines of railway might be laid out so as not to exceed 10,000*l.* per mile, being particularly applicable where fertile, populous, and manufacturing districts, or the metropolis, with the extremes of the empire, had to be connected through difficult and unproductive districts. Mr. Vignoles concluded by remarking, that when a continued stream of heavy traffic justified the expense, he saw no reason to vary from the general rules adopted hitherto by engineers for laying out railways, or from his own former opinions and practice. But it was forced on him by daily experience, that, to accommodate the public convenience, the Post Office arrangements, and business in general, it was scarcely once in twenty times that a locomotive engine went out with more than half its load, and in general the engines were only worked up to two-fifths of their full power: he was, therefore, conclusively of opinion, that it was much cheaper to put on additional engines on extraordinary occasions; and on such principle railways should be constructed through the more remote parts of the country, so as to be made in the cheapest possible manner. The possession of all the *profitable* lines of railway by private companies, was likely to throw on the government the *onus* of constructing their lines through such districts, in which case economy was desirable: or, if not to be constructed by the government, then was economy still more important; for Scotland, Ireland, Wales, and western and eastern England would want railways, until some such system as those now promulgated could be brought to bear in the laying out lines of internal communication.

Mr. Roberts entirely concurred with Mr. Vignoles with regard to the gradients and curves, as also to the propriety of the economy of adopting timber bridges, and so reducing the price of conveyance to the public.—Mr. Vignoles being asked whether, in the gradients of 1 in 100, on the North Union line, any practical danger was to be apprehended, stated that no danger whatever was apprehended; and that, on these gradients of 1 in 100, the trains travelled *down* at full speed, or about forty miles per hour.

Mr. Jeffreys described a *fire-grate*, exhibited in the model-room, which may be placed, he said, so far forwards as to be quite out of the chimney, and radiate a two-fold quantity of heat into the apartment; and yet there shall be no tendency to send smoke into the room. By an addition, in accordance with the same principle, fresh air is introduced, comfortably warmed before it enters the room.

"*Timber Bridges.*"

Mr. Mitchell observed, that Mr. Vignoles having drawn attention to the subject of *Timber Bridges*, with reference to their application to the economical construction of Railways, he begged to report the result of some experience in works of this nature in the Highlands of Scotland. About twelve years ago he had erected a bridge across the Spey, consisting of an arch of 100 feet span; another about six years since of two arches of 100 feet span, with stone abutments and piers; a third across the Dee, of five arches of 75 feet span, with timber piers; besides a number of others of smaller dimensions. Economy was the chief object in building bridges of this material. It was found they were one-third less expensive; that across the Dee with timber piers less than half: the period of duration he found to be from thirty to forty years; the accumulated value of the saving being more than equivalent to rebuilding the structure. In his opinion, viaducts of this material might be beneficially applied in the construction of railways, of course being suitably constructed to resist the violent action and heavy weights of railway trains. He was glad to hear that Mr. Vignoles considered that railways might be constructed with gradients so much steeper than what has been hitherto considered practically advantageous. Of course, there could be but one opinion about the propriety of a level and direct line both for safety and speed: but the subject was of great importance to Scotland, where neither the country admits nor the traffic demands such perfect construction. He thought practical experiments should be made on the amount of locomotive traction at different inclinations, and with different rates of speed; it appears that hitherto engineers had acted more by theory than observation. One fact he would mention. On a railway recently constructed, he found, that with inclinations of from 1 in 70 to 1 in 100, locomotives travelled nearly at full speed, and at one point, an inclined plane of half a mile with a gradient of 1 in 22, a train of loaded carriages, with a gross weight of thirty-five tons, was drawn up with ease, of course at a reduced speed, but not such as to affect the general rate of travelling; the carriages also passed along curves with radii less than 500 feet.

"*On the application of Native Alloy for Compass Pivots.*" By Capt. E. J. Johnson, R.N.

Among those portions of a ship's compass which most affect its working, are the pivots and caps on which the needle and card traverse, and which, like the balance of a chronometer (but of far more importance to the practical navigator), should not only be fitted with the most scrupulous attention to accuracy, but be made of materials capable of maintaining a given form under the trials to which such instruments are necessarily exposed. Having examined a great variety of compasses which had been used at sea, wherein Capt. Johnson noticed that their pivots were generally injured, and often by rust, he searched numerous records of experiments for its prevention, and for improving the quality of steel in other respects, by means of alloys of platinum, palladium, silver, &c. (he alluded particlarly to the experiments of Dr.

Faraday and Mr. Stoddart); and Mr. Pepys having obligingly supplied Capt. Johnson with specimens of similar kinds of steel to those used by them, these examples, together with pivots made of the ordinary kind of steel, and hardened and tempered in the manner recommended by eminent instrument-makers, were placed in a frame for experiment; and to these again Captain Johnson added certain contrivances of his own, such as rubbing a steel pivot with sal-ammoniac, then dipping it into zinc in a state of fusion, and afterwards changing the extreme point. Some specimens he coated with a mixture of powdered zinc, oil of tar, and turpentine; and others again were set in zinc pillars, having small zinc caps, through which the extreme point of the pivot protruded after the manner of black lead through pencil tubes. The whole of the specimens were then placed in a cellar, occasionally exposed to the open air, examined from time to time during more than half a year, and their several states, as respected oxidation, duly registered. Without going into the details of this register, the general result was, that not any of the kinds of steel pivots used in this trial, except such as were coated with zinc, remained free from rust, while the pivot made of the "native alloy" which is found with platinum, completely retained its brilliancy. Captain Johnson then applied a more severe test to this singular substance, first, by placing sulphuric acid, and then nitro-muriatic acid upon it; but even under this trial he could not observe that any change had been effected, although the blade of a penknife, subjected to a similar process, was rusted to the centre. Having enumerated the facts respecting the trials to which he had subjected this curious material, Capt. Johnson stated the conclusion that he had come to, namely, that it is sufficiently tough not to break, and hard enough not to bend, under the trials to which it would be *fairly* exposed; and that being alike free from magnetic properties and liability to oxidation from exposure to the atmosphere, it possesses the requisite qualities for the pivot of the mariner's compass; and he could not but anticipate that, when fitted with a ruby cap to correspond, it would be found greatly to improve the working. Besides the application of this substance for compass pivots, Capt. Johnson stated that it might probably be found advantageous for other instruments, and especially for the points of the axes of the dipping needles fitted, on Mr. Fox's plan, for use on board ship.

Mr. Hawkins has used this "native alloy" for several years in tipping the points of pens, and not a single instance exists of any of these pens showing the least symptom of wear. He tried native alloy on a cap, in comparison with ruby, when he found that in the same circumstances, the ruby was ground away with diamond dust twice as rapidly as the native alloy. He had made engravers' tools of the same metal, and when made too sharp they cannot be blunted on the Turkey stone, but only by diamond dust.—Sir J. Robison could bear testimony to one of Mr. Hawkins's pens, which he had used for years, not being at all changed.—Mr. Hawkins stated that this alloy consists of native crystals of osmium and iridium in conjunction with platinum.

Mr. Lang "*On an Improvement on the Air Pump.*" A letter from this gentleman was read, but from some mistake, the paper itself had not been received.

INSTITUTION OF CIVIL ENGINEERS.

"*On the Properties and Chemical Constitution of Coal, with Remarks on the Methods of increasing its Calorific Effect, and preventing the Loss which occurs during its Combustion.*" By Charles Hood, F.R.A.S., &c.

It appears that, previous even to the invasion of the Romans, coal was used as a fuel in Great Britain; but such was the prejudice against it, that wood was the fuel generally in use among the higher classes until the eighteenth century, when the supply of it diminished so considerably as to render necessary the substitution of coal; and from that time the increase in its consumption has been immense.

Previously to the seventeenth century, the smelting of iron and all other metals was performed by charcoal; but the attempts of Sturtevant and Ravenson in 1612-13, and of Dudley in 1619, to introduce the use of coal or coke in blast furnaces having proved the possibility of success, the progress of the innovation, though slow, was certain, and led to the transfer of the iron works from many of the original positions in the midst of forests to the coal districts where they are now placed.

The author considers his subject under three heads:—1st, The chemical character and composition of coal; 2ndly, Its properties as a combustible; and 3dly, The nature and application of its various gaseous products.

1st. The opinion that coal is a compound of carbon and bitumen has been objected to by some chemists, on the ground that by no process hitherto pursued in analyses has it been possible to resolve it entirely into these two substances; even at a low temperature a quantity of gaseous matter is thrown off, and at an elevated degree of heat an evident decomposition of the bitumen takes place. Even anthracite contains a small portion of volatile matter, its component parts being carbon, oxygen, hydrogen, and nitrogen; the hydrogen being either combined with the oxygen to form water, or with a small portion of carbon to form carburetted hydrogen, which exists in a gaseous state in the pores of the coal. In bituminous coal, the hydrogen is combined with a larger proportion of oxygen and nitrogen; the mechanical difference being, that the bituminous and free-burning coals (more particularly) melt by heat when the bitumen reaches the boiling point, whereas anthracite is not fusible, nor will it change its form, until it is exposed to a much higher degree of temperature.

Two tables of the analyses of different coals are given from the authorities of Mushet, Thomson, Vanuxem, Daniell, Ure, and Reynault; No. 1 showing the proportions of carbon, ashes, and volatile matter, with the specific gravity of the coal and of the coke; and No. 2 showing the proportions of carbon, hydrogen, azote, and oxygen. These tables show that the largest quantity of carbon (92·87) is contained in the Kilkenny anthracite, and the least quantity (64·72) in Cannel coal; and that the nature of the volatile matter greatly affects the quantity of coke—the aggregate quantity of the gaseous products of coking, splint, and cherry coal, being very nearly similar; while the quantity of coke obtained from these different species varies more than 45 per cent.

The author then points out the continual presence of azote, which quits the base with the greatest difficulty; and also the affinity of sulphur, not only for the coal, but for the coke, as it is rarely found to have been completely expelled, even from the most perfectly made coke; the only coal found to be even partially free from it being anthracite, in some species of which no traces of its presence are found.

2dly. The application of coal as a fuel depends on the chemical change which it undergoes in uniting, by the agency of heat, with some body for which it possesses a powerful affinity. In all ordinary cases this effect is produced by its union with oxygen. When coal is entirely consumed, the carbon is wholly converted into carbonic acid gas and carbonic oxide, and the hydrogen into water in a state of vapour. The atmosphere supplies the necessary oxygen for this purpose; and in this state the products of the combination are nearly or quite invisible, both of them being almost colourless fluids; if, therefore, any smoke be visible, it is the result of imperfect combustion. Some calculations are given to ascertain the amount of loss that is sustained when the smoke escapes unconsumed; from which it appears, that with bituminous coal about 37 or 38 per cent. more heat is produced when the smoke is consumed than when it escapes freely. Many modes of consuming smoke have been attempted; those which appear to have been attended with the greatest success are—1st. Causing the smoke from the fresh coals to pass through or over that portion of the fuel which is more perfectly ignited; 2dly. Supplying heated air to the top of the fuel, as well as admitting cold air through the ash-pit in the usual manner; and 3dly, Throwing a jet of steam into the furnace or into the chimney. The various modes of carrying into effect these plans are briefly alluded to; from them a few may be selected. Robertson's plan was to use inclined furnace bars, where the fresh coals were placed close to the fire-door, and being there partially carbonized, gave out the gas, which, in passing over the mass of incandescent fuel, was ignited, and became active flame, thus economizing fuel and preventing smoke. In this and similar cases, by the slow distillation of the coal, a gas is produced, which not only inflames at a lower temperature than the dense olefiant gas produced by rapid distillation, but which only requires for its combustion a quantity of oxygen never exceeding double its own volume, or ten times its bulk of atmospheric air, while olefiant gas requires three times its own volume of oxygen, or fifteen times its bulk of atmospheric air. The elimination of a gas which burns with so small a portion of oxygen is, therefore, the principal cause of the non-production of smoke in furnaces of this description. The second mode of consuming smoke is founded on the necessity which exists for a large supply of air being requisite to inflame the gases given off from coal by a rapid and intense heat; and this is accomplished by introducing a quantity of heated air above the burning fuel. When a quantity of fuel is thrown into a furnace, the increased thickness of the mass opposes additional resistance to the passage of air through the bars; the temperature of the furnace is lowered, and an increased volume of gas is at the same time given out. If at this moment a quantity of air, heated to the temperature of the gas, be admitted, the gas immediately inflames, and that which would have produced a dense black smoke passes off in the invisible state of carbonic acid gas and vapour of water. Different gases require different degrees of heat to inflame them; and this explains the easy combustibility of the volatile products of coal when the heat is so managed as to produce those gases which inflame at the lowest temperature. A larger quantity of air is required at the time that the coal is first thrown on than at a subsequent period; therefore, when economy is studied, the supply of air should be gradually diminished as the mass approaches an incandescent state. The use of heated air has produced most important results in the manufacture of iron with bituminous coal, and also with anthracite; the latter fuel having been almost neglected until the recent application of this principle of employing heated air to promote its combustion, although it is known to be capable of producing perhaps a more intense heat than any other carbonaceous fuel. The rationale of the third plan of consuming smoke by injecting a jet of steam into the fire or the chimney, is less obvious than the others. In 1805, Mr. Davies Gilbert observed, that whenever the waste steam of one of Trevithick's engines was permitted to escape into the chimney, the smoke from the coal was rendered invisible. Subsequent experiments confirmed this fact; and it was supposed that the steam, being decomposed, furnished oxygen to support combustion. The author combats this opinion, and accounts for the effect by the increased draught of the furnace caused by the jet of steam into the chimney, by which means a larger portion of air is brought into contact with the burning fuel; thus supplying the previous deficiency of oxygen to the fire, and promoting the combustion. As steam is only about half the weight of air at a like temperature, and the power of all gaseous fluids to ascend is "inversely as the square roots of their specific gravities," the velocity of its escape by the chimney, compared with common air of the same temperature, is about as 1·4 to 1: therefore the compound mixture of steam, air, and carbonic acid gas, will escape with a considerably increased velocity, and more air must consequently enter the furnace. It appears that about 10 per cent. of the total quantity of steam generated is necessary to effect the combustion of the smoke by this means; therefore, unless the waste steam only be used, the saving of the fuel must be reduced by this amount. Brief mention is made of the experiments of Messrs. Apsley Pellatt, Parkes, and the Chevalier de Pambour, proving that a given quantity of oven coke will produce as much heat as the coal from which it was produced; and of the various kinds of artificial fuels which had been invented, especially that composed of resin and peat coke, of which the author remarks that its combustion probably produces a mechanical effect, as the hydrogen is converted into water in a state of vapour, which escapes through the chimney with a great velocity, and consequently a large quantity of air is drawn into the furnace, and a more perfect combustion of the fuel is the result. In the same manner he accounts for the necessity which exists for having the openings between the bars wider in a furnace in which coke is burned than in one used for coal. In opposition to the general opinion, he considers that less air is required for the consumption of coke than for coal: the carbon only requiring 2⅔ times its weight of oxygen for its combustion, while the hydrogen contained in coal requires 8 times its weight of oxygen: and the only reason that the openings between the bars are required to be wider in the former than in the latter case, is in consequence of the draught being so much slower during the combustion of coke

3dly. "On the nature and application of the volatile products of coal." In treating this portion of the subject—many of the observations on which have been necessarily anticipated in the preceding sections—the author traces the application of carburetted hydrogen gas to the purposes of artificial illumination from the year 1798, when its first successful application was made by Murdock at Soho; he then proceeds to Dr. Henry's investigations of the phenomena of its production and combustion: the variation of the intensity of light obtained from carburetted hydrogen, due to the proportion of carbon contained in it: the difference in the gas obtained from different qualities of coal; the superiority of the illuminating power of the gas from Cannel coal: and the still greater power of that produced from the decomposition of oil, which is 2 to 2½ times greater than that of coal gas. He then mentions the other products of coal by distillation, such as ammoniacal liquor, carbonic acid and oxide, sulphuretted hydrogen, tar, essential oil, naphtha, petroleum, asphaltum, and other substances. The paper concludes by pointing out the advantages which would result from the production of such gas as is usually given out at the beginning of the distillation of coal, as it contains 2 volumes of gaseous carbon united with 2 volumes of hydrogen, and its illuminating power is consequently more than double that of ordinary coal gas.

Mr. Parkes observed, that the quantities of air required for the combustion of different fuels as determined in the laboratory and on the large scale of practice, were frequently very different. It might be quite correct that a given weight of coal would require more air for its perfect combustion than the same weight of coke. There was great difficulty in ascertaining the fact practically, under steam-boilers, as the gases given out by the coal must have air supplied to them distinct from that which passed through the grate to ensure their perfect ignition, and many circumstances prevented the consumption of air from being exactly measured. Generally, he had found it necessary to use wider spaces between the grate bars for coke than for coal. In some late experiments very carefully made on a boiler invented by Mr. A. M. Perkins, equal weights of coal and coke required the same time for their destruction on the same grate, the apertures of the damper and ash-pit door, which were used to govern the draught being precisely the same. Coke effected a greater evaporation than coal at similarly rapid and slow rates of combustion; and in every case the temperature of an oil bath at the foot of the chimney was higher with coke than with coal. It must, however, be remarked, that no process had been used to ignite the gases which escaped from the furnace uninflamed. He had tried different kinds of coke, coal, and anthracite at this boiler, and the same fuel in every instance performed a greater evaporative effect at a slow than at a rapid rate of combustion. He thought that much of the air which entered the grate of a boiler passed through the fire unconsumed, for want of time to effect a sufficiently intimate combination with the fuel. In some experiments lately made at Swansea on the properties of anthracite, Dr. Schafheutl had found from analysis, that no less than 40 per cent. of the products of combustion taken from the chimney consisted of oxygen, yet he had effected the large evaporation of 11 lb. of water with 1 lb. of that fuel.

Mr. Field stated, that Mr. Cooper had expressed an opinion that in the use of coke as a fuel, a less portion of heat reached the chimney than with coal, on account of the large quantity of unconsumed air that passed through the fire, owing to the open spaces necessarily existing between the pieces of such a dry fuel as coke; whereas in a fire made of binding coal, nearly the whole of the air combined with the fuel in its passage through the body of fire.

Mr. Pellatt observed, that although in practice coke appeared to require more air to support combustion than coal did, yet long experience had taught him to believe that when coal was exposed to a rapid combustion, it required more air than coke.

In answer to an observation that some experiments lately made on the measurement of the quantity of air which entered the blast furnaces of Sir John Guest at the Dowlais Iron Works might bear on this subject—Mr. Farey objected to the application of such results to determine the question, as the air is injected with considerable force into a furnace; there is frequently a great reflux of blast from the Tuyere when the furnace is working close; whereas when it is working open the flame at the top shows that the passage of the air through the mass of burning fuel is very free, and that consequently a portion of it passes off unconsumed. He had found in his experiments on blast furnaces, that unless there was a redundancy of carbon, and a deficiency of oxygen, there was no chance of making good iron.

May 26th.—The President in the Chair.

The following were balloted for and elected:—Thomas Illman, Joseph Chessborough Dyer, and G. S. Saunderson, as Associates.

"*On a new Mode of Covering Roofs with Planking.*" By William Cubitt, Assoc. Inst. C. E.

The roof itself is framed in the usual manner with principals and purlins, but without rafters. The boards intended for the covering are cut, by means of a circular saw, from planks 7 inches wide by 2½ inches thick, in such manner that each plank makes two boards, the one tapering from its centre towards the edges, the other from its edges towards the centre. The hollow boards are laid side by side, at intervals of 4½ inches, and nailed to the purlins by their centres only, so as to admit of shrinking; the intervening spaces are then covered by the other boards, overlapping 1¼ inch on each edge, and nailed in like manner. The covering thus formed presents a series of alternate elevations and depressions, longitudinally from the ridge to the gutter, and consequently the rain falls off very rapidly, and a roof so constructed is easily kept water-tight. The author conceives this to be the most economical mode of using timber for covering, and he has adopted it extensively. The communication was accompanied by a model of the roof and specimens of the boards as they are left by the saw.

"*On Long and Short Connecting-rods for Marine Engines.*"

A letter was read from Ardaseer Cursetjee, of Bombay, inviting a discussion on the relative advantages of long and short connecting rods for marine engines. He was induced to make inquiry on this subject from some observations in a communication to the Institution, relative to the engines of the steam tug the "Alice" (Minutes of Proceedings, page 385). In that paper their superiority is in part attributed to the increased length of the connecting rods. This is the point upon which he requests information, as he conceives that the power of the piston upon the crank is the same whatever may be the medium through which it is transmitted, and the effect to be the same throughout a complete revolution, whether the connecting rod be long or short, except that from the increased angle of a very short connecting rod some additional friction is thrown upon the joints.

On the general construction of the engine of the "Alice," he remarks, that engines of similar form are now used for pumping at the Thames Tunnel under Mr. Brunel's direction; and that a pair of engines of this kind were built by Messrs. Seaward, 13 years ago, for the "Staadt Francfort" steamboat, to ply between Francfort and Coblentz; in this instance, the cylinders were firmly fixed to the bed-plate and sleepers, with the cross bars above the cylinders, thus having one connecting rod only leading to the cranks, which he considers a superior arrangement to that of the engines of the "Alice."

A drawing of the engines of the "Staadt Francfort" accompanies the communication.

A letter was read from Mr. John Cooper, of Dover, describing the effect of the worm (*Teredo navalis*) on several kinds of timber which had been exposed to the action of sea water. The kinds of timber on which the experiments were made were fir, English oak, and African oak; specimens of each sort, some Kyanized and the others unprepared, having been tried under exactly similar circumstances on the piles of the south pier of Dover harbour. The results show that Kyanizing timber does not in any degree protect it; as, after exposure from December 1837 until May 1840, it was found that the worm made equal ravages among all the specimens. The author also tried the process of saturating timber with copperas water, but did not find any good result from it. In July 1835, he placed under water some 2-inch oak planks which had been prepared with copperas; and on examining them in May 1840, they were found to be as much attacked by the worm as the worst specimens of unprepared fir timber which had been exposed for a similar length of time. The African oak resisted the attack of the worm better than either fir or English oak.

It was stated that Teak timber resisted the attacks of the worm and of the white ant, which destroy all other kinds of timber. It is, however, liable to injury from the attacks of barnacles.

"*On the Corrosion of Cast and Wrought Iron in Water.*" By Robert Mallet, Assoc. Inst. C. E., &c.

This communication is one of those forwarded to the Institution in consequence of the Council having considered this subject a suitable one to compete for the Telford Premiums; and the author having been long engaged in making experiments on this subject at the request of the British Association, refers in the introductory part of this paper to the contents of that report, which may be viewed as a "*précis*" of the state of our knowledge on the subject to the year 1839, together with original researches forming the basis of the present results. This communication is accompanied by a most elaborate set of tables of results; but these laborious investigations being yet in progress, the author directs his special attention to so much only of the subject as may be necessary for their elucidation, divesting his remarks as much as possible of a purely chemical character, and confining them to those practical conclusions which are of immediate use and importance of the engineer.

The tables of results are altogether twelve in number. The first five contain the data and results of the chemical or corroding action of sea and fresh water on cast and wrought iron under five several conditions, during a period of a year and ten months; and these five series of experiments are so coordinate with each other as to form one connected and comparable whole, whence the relative rates and absolute amounts of corrosion of cast and wrought iron—by, 1. clear sea water, 2. foul sea water, 3. clear sea water at temperature 115° F., 4. foul river water, and 5. clear river water—may be ascertained. The corrosive action of water and air combined produces on the surface of cast or wrought iron a state of rust possessing one of the five following characteristics—1. Uniform, 2. uniform with plumbago, 3. local pitted, 4. local pitted, 5. tubular—or of two or more of these characteristic conditions in combination; these facts for 82 different specimens of British and Irish cast iron--together with their original external characters, mode in which they were cast, specific gravity, dimension and weight before and after immersion, loss of weight per square inch of surface, this loss referred to a standard bar, and the weight of water absorbed for clear sea water—compose Table I. The four subsequent tables contain similar results for specimens of iron immersed under the other four conditions mentioned above. These five tables contain also the results of the corrosion of certain cast iron protected by either of ten several paints or varnishes, the results of which are comparable with those for the unprotected iron. Table VI. exhibits the general comparison of the results set forth in the preceding tables for specimens of iron one inch thick, and reduced to one common or equal period of immersion. Table VII. shows the *average loss* of all varieties of cast iron experimented on per square inch of surface. Table VIII. the average calculated amount of corrosion (assumed uniform) of various specimens of cast and wrought iron per superficial foot of surface at the end of one century. From these tables it appears, that the metallic destruction or corrosion of the iron is a maximum in clear sea water of the temperature of 115° F.—that it is nearly as great in foul sea water—and a minimum in clear fresh river water.

Iron under certain circumstances is subject to a peculiar increase of corrosive action—as, for instance, cast iron piling at the mouth of tidal rivers—from the following cause. The salt water being of greater density than the fresh, forms at certain times of tide an under current, while the upper or surface water is fresh; these two strata of different constitutions coming in contact with the metal, a voltaic pile of one solid and two fluid elements is formed; one portion of the metal will be in a positive state of electrical action with respect to the other, and the corrosive action on the former portion is augmented. The lower end of an iron pile, for instance, under the circumstances just mentioned, will be positive with respect to the other, and the corrosion of the lower part will be augmented by the negative state of the upper portion, while the upper will be *itself* preserved in the same proportion. From this theoretical view may be deduced the important practical conclusion, that the lower parts of all castings subject to this increased action should have increased scantling.

The increased corrosive action of *foul sea* water may be referred to the quantity of hydrosulphuric acid disengaged from putrifying animal matter in the mud, converting the hydrated oxides and carbonate of iron into various sulphurets, which again are rapidly oxidized further under certain conditions, and becoming *sulphates* are washed away. Hence the rapid decay of iron in the sewage of large cities, and of the bolts of marine engines exposed to the bilge water. The corrosive action being least in fresh water may be partly referred to this being a worse voltaic conducting fluid than salt water.

It appears also that wrought iron suffers the greatest loss by corrosion in hot sea water; which fact has led the author to inquiries, with reference to marine boilers, at what point of concentration of the salt water, whether when most dilute, after the common salt has begun to deposit, or at a farther stage of concentration, the corrosive action on wrought iron is the greatest, and he points out the important practical use which can be made of this information. It appears also, that the removal of the exterior *skin* of a casting greatly increases the corrosive action of salt water and its combined air, so that the index of corrosion under these circumstances is not much less than that of wrought iron, and in clear river water is greater.

It farther appears, that chilled cast iron corrodes faster than the same sort of cast iron cast in green sand, and that the size, scantling, and perhaps form of a casting, are elements in the rate of its corrosion in water. The explanation of these facts is to be found in the want of homogenity of substance, and the consequent formation of numerous voltaic couples, by whose action the corrosion is promoted. It is also observable that the corroded surface of all these chilled specimens is tubular.

It appears also that, in castings of equal weight, those of massive scantling have proportionately greater durability than those of attenuated ribs and feathers. Hence appears also the great advantage of having all castings, particularly those intended to be submerged, *cooled in the sand*, so as to insure the greatest possible uniformity of texture. The principles now stated afford an explanation of the fact often observed, that the back ribs of cast iron sheet piling decay much faster than the faces of the piles. It is also probable that castings in dry sand and loam will, for these reasons, be more durable than those cast in green sand. The general result of all these experiments gives a preference to the Welsh cast iron for aquatic purposes, and to those which possess closeness of grain. Generally, the more homogeneous, the denser and closer grained, and the less graphytic, the smaller is the index of corrosion for any given specimen or make of cast iron.

The author next proceeds to the important question of the protection afforded by paints and varnishes. White lead perishes at once in foul water, both fresh and salt; and caoutchouc dissolved in petroleum appears the most durable in hot water, and asphaltum varnish or boiled coal tar laid on while the iron is hot under all circumstances. The zinc paint, which is now so much noticed as an article of commerce, the author has analyzed, and states its composition as—

Sulphuret lead . . .	9·05
Oxide zinc . . .	4·15
Metallic zinc . . .	81·71
Sesqui-oxide iron . . .	0·14
Silica	1·81
Carbon	1·20
Loss	1·94
	100·

It may, *a priori*, be considered likely to produce a most excellent body for a sound and durable paint under water. The black oxide of manganese has no advantages but that of being a powerful drier. The defects of all oil paints arise from the instability of their bases; the acids which enter into the constitution of all fixed oils readily quit their weakly positive organic bases to form salts with the oxides of the metal on which they may be laid. Hence we must look for improvements in our paints to those substances among the organic groups which have greater stability than the fat or fixed oils, and which, in the place of being acid or Haloid, are basic or neutral. The heavy oily matter obtained from the distillation of resin, called "resenien." and eupion, obtained from rapeseed oil, have valuable properties as the bases of paints.

Tables IX. and X. contain the results as to the corrosion of cast iron in sea water when exposed in Voltaic contact with various alloys of copper and zinc, copper and tin, or either of these metals separately, per square inch of surface. It appears that neither brass nor gun metal has any electro-chemical protective power over iron in water, but on the contrary promotes its corrosion. This question is only a particular case of the following general question: viz. if there be three metals, A. B. C., whereof A. is electro-positive, and C. electro-negative, with respect to B., and capable of forming various alloys, $2\,A + C \ldots\ldots A + C \ldots\ldots A + 2\,C$; then if B. be immersed in a solvent fluid in the presence of A., B. will be electro-chemically preserved, and A. corroded, and *vice versa*. If B. be so immersed in the presence of C., B. will be dissolved or corroded, and C. electro-chemically preserved; the amount of loss sustained in either case being determined according to Faraday's "general law of Volta-equivalents." The tables show that the loss sustained by cast iron in sea water, as compared to the loss sustained by an equal surface of the same cast iron in contact with copper, is 8·23 : 11·37; and when the cast iron was in contact with an alloy containing 7 atoms of copper and 1 of zinc, the ratio was 8·23 : 13·21; so that the addition in this proportion of an electro-*positive* metal to the copper produces an alloy (a new metal, in fact) with higher electro-negative powers, in respect to cast iron, than copper itself. The author discusses many results equally remarkable, and is therefore enabled to suggest by its chemical notation the alloy of "no action," or that which in the presence of iron and a solvent would neither accelerate nor retard its solution, one of the components of this alloy being slightly electro-negative, and the other slighly electro-positive, with respect to cast iron. These results will also enable some advances to be made towards the solution of the important problem proposed by the author in his former report, viz. "the obtaining a mode of electro-chemical protection, such that while the metal (iron) shall be preserved, the protector shall not be acted on, and the protection of which shall be invariable."

Table X. exhibits especially the results of the action of sea water on cast iron in the presence of copper and tin or their alloys. It appears that copper and tin being *both* electro-negative with respect to cast iron, all their alloys increase or accelerate the rate of corrosion of cast iron in a solvent, though in very variable degrees; the maximum increase is produced by tin alone, thus indicating that this metal (contrary to what was previously believed) is more electro-negative to cast iron than copper. Hence the important practical deduction, that, where submerged, works in iron must be in contact with either alloy, viz. brass or gun metal; common brass, or copper and zinc, is much to be preferred. These experiments will also serve to demonstrate the fallacy of many of the patented so-called preservatives from oxidation, which are brought before the public with so much parade.

The author lastly proceeds to the subject of the specific gravity of cast iron, tables of which are added to the preceding. The specific gravities here recorded were taken on equal sized cubes of the several cast irons cut by the planing machine, from bars of equal size, cast at the same temperature, in the same way, and cooled in equal times. Many of these results differ considerably from those given by Dr. Thompson and Mr. Fairbairn; which the author refers to the probability that those of Dr. Thompson were taken from pieces of the raw pig, and those of Mr. Fairbairn by weighing in air equal bulks cut from the mass by the chisel and file, by which latter process the volume is liable to condensation. The experiments of Mr. Fairbairn and Mr.

Eaton Hodgkinson seem to show that the ultimate strength of cast iron is in the ratio of some function of the specific gravity dependant upon the following conditions: viz. 1. the bulk of the casting; 2. the depth or head of metal under which the casting was made; 3. the temperature at which the iron was poured into the mould; 4. the rate at which the casting was cooled.

Table XI. All the irons experimented on are arranged in classes, according to the character of the fracture; for which purpose the terms—1. silvery, 2. micaceous, 3. mottled, 4. bright grey, 5. dull grey, and 6. dark grey, have been adopted by the author as a sufficient basis on which to rest a uniform system of nomenclature for the physical characters of all cast irons, as recognisable by their fracture; and it is to be wished that experimenters in future would adopt this or some other uniform system of description, in place of the vague and often incorrect characteristics commonly attached to the appearance of the fracture of cast iron.

The twelfth and last table contains the results of a set of experiments on the important subject of the increase of density conferred on cast iron, by being cast under a considerable head of metal, the amount of which condensation had not been previously reduced to numbers. It shows this increase of density in large castings, for every 2 feet in depth, from 2 to 14 feet deep of metal.

A very rapid increase of density takes place at first, and below 4 feet in depth a nearly uniform increment of condensation.

The importance of these results is obvious; for, if the ultimate cohesion of castings is as some function of their specific gravity, the results of experiments in relation to strength, *made on castings of different magnitudes, or cast under different heads*, can only be made comparable by involving their variable specific gravities in the calculation.

June 2—The PRESIDENT in the Chair.

The following were balloted for and elected:—Lieutenant T. H. Sale, B.E., and George Larmer, as Associates.

June 16—The PRESIDENT in the Chair.

The following were balloted for and elected:—William Jory Henwood, as a Member; John Thomas Cooper and John Oliver York, as Associates.

"*On the Action of Steam as a Moving Power in the Cornish Single Pumping Engine.*" By Josiah Parkes, M. Inst. C. E.

In this communication, the author presents a detailed analysis of some of the facts collected and recorded by him in his former communications, with the special object of ascertaining from the known consumption of water as steam, the whole quantity of action developed—the quantity of action had it been used unexpansively—the value of expansion—the correspondence between the power, and the resistance overcome—and, finally, a theory of the steam action, with a view of determining the real causes of the economy of the Cornish single pumping engine.

The data employed for the purposes of this investigation are those obtained from the Huel Towan engine by Mr. Henwood, from the Holmbush by Mr. Wicksteed, and from the Fowey Consols, and recorded in the author's communications in the Transactions of the Institution of Civil Engineers, Vols. 2 and 3.

Steam may be applied in one or other of the two following modes: expansively, that is, when admitted into the cylinder at a pressure greater than the resistance, and quitting it at a pressure less than the resistance; or unexpansively, that is, when its pressure on the piston is equal to the resistance throughout the stroke. By the term *economy* in the use of steam, is meant the increase in quantity of action obtained by the adoption of that mode which produces the greatest effect.

The weight of pump-rods, &c., which effects the pumping or return stroke in a Cornish engine is greater than the weight of the column of water, by the amounts necessary to overcome the friction of the water in the pipes—to displace the water at the velocity of the stroke—to overcome the friction of the pitwork, and of the engine itself. The absolute resistance opposed to the steam, consists of the weight which performs the return stroke, plus the friction of the engine and pitwork, and the elasticity of the uncondensed steam.

The water-load in the Huel Towan engine was very accurately ascertained as 11 lbs. per square inch on the piston; and it is shown that the additional resistance amounted to 7 lbs. in the Huel Towan, and to 6 lbs. in the other engines, so that the whole resistance in the Huel Towan engine is 18 lbs. per square inch of the piston. Now, the elastic force of the steam at the termination of the stroke, and before the equilibrium valve is opened (ascertained from the ratio of the volumes of steam and water consumed), is only 7 lbs. per square inch, that is, 4 lbs. less than the water-load alone. The corresponding results for the other two engines are equally remarkable, and show most distinctly that, at the termination of the stroke, the pressure of the steam is far below the water-load, as had been previously observed by Mr. Henwood and others.

The next step in the analysis is to determine the portion of the stroke performed when the pressure of the steam in the cylinder is just below the resistance, and then to separate and estimate the spaces through which the piston is driven respectively by steam of a pressure not less than the resistance, and less than the resistance. These facts being ascestained, the virtual or useful expansion, and the dynamic efficiency of the steam, during the two portions of the stroke, are known; and it appears that there is a deficiency of power, as compared with the resistance overcome, of above 3 lbs. in the Huel Towan, and more than 4 lbs. in the other engines, per square inch on the piston.

From these startling facts, and a careful examination of Mr. Henwood's indicator diagrams, the author was induced to inquire whether the piston had not been impelled by a force altogether distinct from the continuous action of the steam upon it, namely, by a force which is to be referred to the sudden impact on the piston when the admission valve is so fully and instantaneously opened, as it is in these engines, and a free communication established between the cylinder and the boiler. To this instantaneous action on the piston, the author, for the sake of distinction, assigns the term *percussion;* and, proceeding to analyse the authentic facts under this view, it appears that the space of the cylinder though which the piston was carried by virtue of this percussive action was about 21 inches in the Huel Towan, 27 inches in the Holmbush, and 33 inches in the Fowey Consols engines.

The results thus unfolded, which are facts independent of any hypothesis, appear less startling on a full consideration of the circumstances under which the steam is admitted into the cylinder. The engine has completed a stroke, and is brought to rest by the cushion of steam between the piston and the cylinder cover; a vacuum is formed on the other side of the piston; the elastic force of the steam in the cushion then nearly balances the resistance. A communication is now suddenly opened between the cylinder and the boiler containing steam of a high elasticity; and the piston, being ready to move with a slightly increased pressure, receives a violent impulse from the steam's instantaneous action. The piston having started, the influx of the steam is more or less retarded by the throttle valve, and its elastic force, though at first greater than the resistance, is soon reduced considerably below it, the mass of matter in motion acting the part of a fly wheel, absorbing the excess of the initial power over the resistance, and discharging it by degrees until the stroke is completed.

The indicator diagrams, which are the transcripts of the piston's movements, show that such may be the nature of the action on the piston, and the discussion of numerous well-established facts and phenomena, for the Cornish engines, strongly confirms this view of the case. Whatever may be the theory of the steam's action, the fact that the sum of those actions has carried the piston through its course, is certain; and it seems equally certain that the quantity of water as steam which entered the cylinders was insufficient alone to overcome the resistance.

The author then investigates the amount of useful action due to the steam imprisoned between the piston and the cylinder cover, and recovered each stroke, which, for its use in bringing the engine to a state of rest at the end of the return stroke, he terms the *cushion.* This quantity, though small, is appreciable, and its value is assigned for each engine.

The author treats lastly of the evidence furnished by the diagrams of the indicator, and of its utility as a pressure gauge. The communication is accompanied by elaborate tables of the results of the analysis, and an appendix with the calculations worked out in detail.

SCIENTIFIC SOCIETY.

The opening meeting of the present Session was held by the Scientific Society on Thursday evening, Nov. 19, at their rooms in Great Russell-street, Bloomsbury. In the absence of the President, one of the Vice-Presidents, John Stevens, Esq., delivered the annual address, in which, after adverting to the advanced position of the institution, he explained, at some length, its characteristic features, and the peculiar objects which it is designed to promote. The great and known want of adequate facilities for collecting and registering scientific observations, seriously impeded the progress of inductive generalization,—facts are lost for want of channels through which they may be brought to a common centre, and there has never yet been formed a Museum of recorded and classified data, to which the scientific inquirer may resort for evidence to support or subvert theoretical views. The leading purpose of the Scientific Society is to supply this deficiency, but they can only hope to succeed in so arduous an undertaking, by the most active individual exertion, and by the friendly co-operation of those who are interested in the advancement of science. After the address a paper was read on a new discovery in Electrotype. The meeting was numerously attended, both by members and visitors, which evince the interest taken in the proceedings of the society.

KING'S COLLEGE.

We understand that regretting the necessity of refusing many applications for admission of students, whose age and previous character were not sufficiently advanced, into the civil engineering department—and feeling at the same time the advantage of having their previous education directed to those studies, which would ground them in the subjects of the more extensive readings of the senior class, and convinced as well, that even to a general studen would be useful, some knowledge of the principle and nature of that mechanism and machinery which is now becoming the subject of every day remark and conversation, without which the education of the gentleman is scarcely complete, the council of the college have established a junior class for students of 14 years and upwards.

ARCHITECTURAL SOCIETY.

The Tenth Session of this Society was opened on the 3rd ult., at their apartments in Lincoln's Inn Fields, with a conversazioné. The President, William Tite, Esq., F.R.S., the Architect of the New Royal Exchange, took the Chair at nine o'clock; when the Secretary, Mr. Grellier, proceeded to read the Report of the Committee, which stated the arrangements made for the lectures and papers of the ensuing session, and announced five prizes for the competition of the student-members, upon the following subjects :—The best architectural composition; the best measured drawing of the front of St. George's Church, Bloomsbury; the best series of architectural sketches produced during the season; the best notes of the lectures delivered at the several meetings of the Society; and the best drawing in chalk or pencil from the plaster figure.

The President then read an elaborate essay on the history, chemistry, and uses of bitumen and its compounds, tracing the facts of their application from the earliest times, with illustrations from the Bible, from Herodotus, Diodorus Siculus, Josephus, Dioscorides, Vitruvius, and Pliny. The lecturer then described the various kinds of bitumen, beginning with its most liquid state of naptha, and descending to petroleum, mineral tar, mineral pitch (sometimes called maltha), and then to the compact bitumen known as asphaltum, elastic bitumen, or mineral caoutchouc, mineral wax, and mineral tallow. This part of the dissertation was illustrated by specimens of most of these substances on the lecture table, and by references to the principal sources from which they are derived in the present day. It appears that, for the purpose of commerce and the arts, they are now obtained from the mines of Avlona in Albania, of Lobsaun in Alsace on the left bank of the Rhine, from Pyremont, which furnishes the asphalte of Seyssel, known in England as Claridge's, besides the asphaltes of the Landes known as the Bastenne and Gaujac. Bitumens, in various states, are also found in great abundance at Rangoon, in the Birman Empire, at Coxitambo in South America, in the famous Pitch-Lake of the Island of Trinidad, in the celebrated Naptha Wells at Baku on the Caspian, in Persia, in Greece, Sweden, Gallicia, Moldavia, Sicily, England, and, in fact, in all parts of the world. In many cases, the varieties are found pure; and in others, as at Seyssel and Lobsaun, they are mixed with argillaceous sands, calciferous bitumens or bituminous grits or shales: all the deposits appear to belong to the tertiary formation. There are various opinions as to their origin; their chemistry, however, would seem to indicate that they must have been derived from the destructive distillation of vegetable matter, the produce of ancient forests. Among other curious facts facts stated by the lecturer, it was mentioned that the streets of Parma are lighted with petroleum from the mines of Avlona; and that a kind of purified bitumen had been, for some centuries, used in Paris for greasing the wheels of carriages, under the name of *graisse noire*.

The introduction of bitumen into mastic, for the purposes of paving, lining tanks, &c., though recently revived in Paris as a novelty, does not appear to be so. Mr. Tite noticed upon this subject, a Tract in the British Museum, entitled, "Dissertation sur l'Asphalte, ou ciment naturel, decouvert depuis quelques années au Val Travers, dans la Comté de Neufchatel, par le Sieur Eirini d'Eyrinys, Professeur Grec, et Docteur en Medecine. Avec la manière de l'employer, tant sur la pierre que sur le bois; et les utilitée de l'huile que l'on en tire." Paris, 1721, 12mo. From this tract the following extracts were read; from which it would seem that the proportions and applications of bitumen in mastic were known more than a century since. "Pour former le ciment, et le mettre en état d'être employé, il faut prendre la mine toute pure, et la bien pulvériser. Pour le faire avec moins de peine et de frais (car elle est fort dure), on peut l'attendrir en la mettant devant le feu, ou à sec dans un chaudière. Dès qu'elle sentira la chaleur, on la broyera très facilement; il vaut, cependant, mieux la piler froide, parcequ'en la chauffant, l'huile s'évapore, et elle perd beaucoup de sa qualité et de sa force.

"Quand elle est absolument écrasée, et réduite comme du terreau, on prend de la poix de Bourgoyne blanche ou noire (la blanche est la meilleure) on la fait fondre a petit feu dans une chaudière de cuivre ou de fer; quand la poix est entièrement fondue, it faut prendre garde que le feu n'y prenne; on y mêle peu à peu l'asphalte en le remuant continuellement avec un bâton ou spatule, jusqu'à ce que l'incorporation soit faite, on le voit parceque l'asphalte doit être liquide comme de la bouillie; la doze de la poix est la dixième partie, c'est à dire, qu'il faut neuf livres de mine et une livre de poix pour former le ciment dans sa perfection."

After giving an account of the manner of employing the asphalte as mortar, the author continues,

"L'on pourroit encore faire des bassins, réservoirs, citernes et terrasses, mème sans employer des pierres de taille, et cette façon, qui couteroit moins que les autres, servit aussi solide, et auroit sa beauté, &c. &c."

His recommendations of the invention are warm :—

"Quand le ciment d'asphalte est fait éxactement, il resiste également au chaud et au froid; la plus grande ardeur du soleil, ni la gelée la plus forte, n'y peuvent faire aucun dommage. Je crois avoir trouvé la chose du monde la plus avantageuse pour le public, principalement pour Paris, &c. &c."

The lecturer exhibited tables showing the chemical analysis of various substances from recent woody fibre down through the lignites, coals and jets to the most compact anthracite, and from the recent turpentine through the napthas, pitches, &c., down to the asphaltes. He pointed out the chemical analogy or isomerism of many of these substances, as contrasted with their uses and appearances. In the course of the lecture, reference was made to the ruins of Babylon and Nineveh, as well as to the ancient Oracles and Nymphæa connected with the springs of Naptha, and particularly to the ruins of Avlona, which seem to connect the ancient Nymphæum spoken of by Strabo and Dio Cassius, on the banks of the Aias, or Aous, the modern Viosa, with the mineral pitch formation of Selenizza, furnishing the modern asphalte of Avlona.

Mr. Tite explained, at some length, the composition of the asphalte mastics, recommending to the notice of the architects present a careful consideration of their application and introduction.

The lecture was received with the strongest marks of approbation from a very large auditory, including many of the leading members of the Royal Society, the Society of Civil Engineers, the Society of Arts, and the Institute of Architects; and, after the announcement of various donations to the Library and Museum of the Society, the meeting separated.

INTERESTING EXPERIMENTS WITH LOCOMOTIVE ENGINES, ON THE HULL AND SELBY RAILWAY.

On Tuesday, the 10th ult., a course of five days' experiments commenced with the engines of the above Railway, originating through the following circumstances :—

About the commencement of the present year, six engines, somewhat similar to those on the Leeds and Selby line, were in a greater or less state of forwardness for the Hull and Selby Railway, at the works of Messrs. Fenton, Murray, and Jackson, of this town, when the Hull and Selby Railway Company resolved to have six other engines, on the most approved construction which experience up to that period could produce, from the previous working of locomotives on the various Railways. Four objects were particularly kept in view, namely, *safety*, *simplicity*, *accessibility* of the various parts, and *economy*, the whole combining general *efficacy* and *durability* of the engine throughout.

The first object is secured by giving a more extended *base* for the action of the springs in supporting the weight of the engine, being about six and a half by eleven feet, whereby a remarkably steady motion is secured at thirty miles per hour. It is not at all a matter of surprise that the four wheel engines of several Railways now in use should every now and then go off the road, and in an instant, when it is recollected the extreme base of their springs for supporting the engine is only about three three quarters by about six feet; hence their rocking, serpentine, and pitching motion, which without any other cause than a slight increase of speed, literally lifts the flanges of the wheels above the surface of the rails, and in three or four seconds the engine is turned end for end, upset in the act, and the train with it; whilst the stability of the engine is effectually secured through an extended base upon the front and hind wheels. By means of a new combination, the best properties of the four-wheeled engines are also completely applied, by resting the weight on the crank shaft immediately within the wheels, which experience has for years proved to be the place least likely to injure it, and thereby avoid the alarming accidents which have so often taken place by the breaking of the shaft, through placing the weight on bearings outside of the wheels; the centre of the engine being a sort of neutral axis, there is very little power over its motion in that part, and this advantage, by placing the weight on the crank inside the wheels, is, in consequence, got without a sacrifice of stability.

Secondly,—In addition to the safety and simplicity of having only *two* inner frames, instead of three or four, with as many bearings on the crank shaft, the space under the boiler is still further stripped of machinery by a new valve motion, which gives a high degree of openness and facility of access so desirable in examination, cleaning, &c , of the working parts.

Thirdly,—The steam being used expansively by the valve motion above alluded to, a great saving in fuel is effected, as will be seen on examining the results of the experiments, and as the excessive wear and tear of locomotive boilers arises from intense heat, it is not improbable this decided step towards removing the cause will prevent the effect, namely, the rapid destruction of the boiler. The action of this valve motion is perfectly smooth, being worked by eccentrics (which are also of an improved construction), and any quantity of steam from 25 to 90 per cent. on the stroke can be admitted into the cylinders with the most ready and complete control, at any speed the engine may be going; if a high wind or an incline oppose the progress of the engine, a greater quantity of steam is admitted; if wind or gradients be favourable, the steam is still admitted at full pressure into the cylinders, but shut off at an earlier period, propelling the pistons the remainder of the stroke by its elastic force, similar to driving a time-piece by the uncoiling of the main spring.

Lastly,—A combination of dimensions and proportions have been gleaned from the best results of locomotive engines of various constructions, and in use in different parts of the country. The driving wheels are 6 feet diameter, length of the stroke 2 feet, diameter of cylinders 12 inches, inside dimensions of fire-box, 2 by 3½ feet, tubes, 94 in number, by 9½ feet long, and 2 inches diameter. The general diminution of machinery in the construction has given room for ample dimensions in the principal working parts, and thus the whole arrangement has a close bearing on *safety*, *simplicity*, *accessibility*, *and economy*.

Circumstances led to those engines being ordered of Messrs. Shepherd and

Todd, Railway Foundry, of this town. The Hull and Selby line was opened with the engines of the former order, but the public and the company being so much annoyed by hot cinders from their chimneys, burning whatever they lighted upon, and rapidly destroying the smoke boxes themselves, three of those engines were altered, and succeeded to a considerable extent in diminishing the nuisance, whilst the engines performed better, and with less fuel. That fact, however, being questioned, and two engines of the *improved* construction having got to work, Mr. John Gray, the engineer of the locomotive department, and patentee of the improved engines, urgently requested a most rigorous and simultaneous trial of the different engines, and to be witnessed for the parties concerned by persons above suspicion. Mr. J. Miller and Mr. T. Lindsley represented Messrs. Fenton, Murray, and Jackson; Mr. J. Craven and Mr. J. Barrons represented Messrs. Shepherd and Todd; and Messrs. E. Fletcher, W. B. Bray, J. G. Lynde, jun., J. Farnell, and J. Gray, were the repreaentatives of the Hull and Selby Railway Company. The arrangements for the experiments were, that the gross load should include engine, tender, carriages, and every thing in the train.

The steam was got up in the respective engines to the pressure of from 56 to 66 lb. per square inch; the fires filled to a certain level at the starting in the morning, and filled to the same level on finishing the last trip at night. The pressure of steam at starting was generally up to 66 lb. and was at about half that pressure at the end of each trip. There were *fifty* experimental trips made in all, namely, twenty-four trips with the *Collingwood*, *Andrew Marvel*, and *Wellington*, the unaltered engines of Messrs. Fenton, Murray, and Jackson. Their average gross load was 53·4 tons, or 1656 tons, over one mile: consumption of coke 1013 lb. or 0·611 lb. per ton per mile; water, 6500 lb. or 3·90 lb. per ton per mile. There were ten trips made with the other three engines of Messrs. Fenton, Murray, and Jackson, which were altered at Hull, namely, the *Exley*, *Kingston*, and *Selby*. Their average load was 49·16 tons, or 1524 tons over one mile; consumption of coke, 635 lb. or 0·416 lb. per ton per mile: water, 4264 lb. or 2·79 lb. per ton per mile.

The *patent* engines made by Messrs. Shepherd and Todd, viz. the *Star* and *Vesta*, made sixteen trips, and their average loads, &c., were 55·4 tons, or 1718 tons over one mile; coke consumed, 465 lb. or 0·271 lb. per ton per mile; water, 2874 lb. or 1·62 lb. per ton per mile. The average gross load of all the fifty trips is 53·2 tons, or 1649·4 tons over one mile, and taking that as a standard load, the consumption of fuel and water performing exactly equal quantities of work, is represented in the following tables :—

Class of Engine.	Load in tons conveyed over one mile, in lbs.	Elsecar Coke used per trip of 31 miles, in lbs.	Coke used per mile, in lbs.	Coke used per ton per mile, in lbs.	Water used per trip of 31 miles, in lbs.	Water per mile in lbs.	Water per ton per mile, in lbs.
Patent	1649·4	446·98	14·41	0·271	2672	86·19	1·62
Altered	1649·4	686·15	22·13	0·416	4601·6	148·43	2·79
Unaltered	1649·4	1007·78	32·59	0·611	6432·8	207·5	3·90

The financial annual resnlt of the three classes of engines for coke and boilers, with such a traffic as that of the Hull and Selby line, will be about—

£4,500 for the unaltered engines.
£3,250 for the altered ditto; and about
£2,000 for the patent engines.

In conclusion, it is deserving of remark, that *all* the attesting witnesses expressed themselves highly satisfied with the manner in which the experiments had been conducted, and with the facilities which the Company so readily granted to enable them to come at correct results. Probably no experiments were ever made under similar circumstances where the parties concerned displayed greater independence, impartiality, and good feeling than on the present occasion.—*Leeds Mercury.*

PATENT LAW.

An Important Case of Patent Law regarding the Amendment of Specification was heard in the Rolls' Court, on Friday, Nov. 6.

IN THE MATTER OF JOHN SHARP'S LETTERS PATENT.

The petition of Joshua Wordsworth, of Leeds, machine-maker, for expunging from the memorandum of alterations in the specification of Sharp's letters patent "for machinery for converting ropes into tow, &c.," such portions as were in substance descriptive of the same machinery as was invented by the petitioner Wordsworth, was resumed, and Mr. Bacon for Mr. Sharp followed Mr. Hill against the petition, and Mr. Pemberton, in behalf of Wordsworth, the petitioner, replied.

By statute 5 and 6 William IV., c. 73, "to amend the law touching letters patent for inventions," it is enacted "that any person having obtained letters patent for an invention may enter with the clerk of the patents (having first obtained the leave of the Attorney or Solicitor-General) a disclaimer of any part of his specification, or a memorandum of any alteration therein which is to be deemed part of such specification." Wordsworth's petition stated that letters patent were granted in October, 1836, to Sharp to make and vend his invention, part of which the petitioner stated was applicable to the preparing cotton wool and silk for spinning. The specification was enrolled in April, 1837. In May, 1838, letters patent were granted to the petitioner Wordsworth for an invention of improvements in machinery "for heckling and dressing flax, hemp, and other fibrous materials," and in November following the specification was enrolled. The petition then stated, that after this enrolment he (Wordsworth) discovered that Sharp had, in September, 1838, obtained from the Solicitor-General a certificate that Sharp had applied for leave to enter with the Clerk of the Patents certain memorandums of alterations of parts of his specification, and that the Solicitor-General had directed him to advertise the alterations, which was done; and, no objection having been made, the Solicitor-General granted leave to Sharp to file the memorandum of alterations, which alterations the petitioner stated were a new arrangement of machinery, and extended Sharp's patent to what were in substance his (Wordsworth's) inventions, as described in his specification. The petitioner submitted that the statute did not authorize the addition to a specification of any description of new machinery, and prayed for expunging the memorandum of alterations.

For the petition it was argued by Mr. Pemberton and Mr. James Russell, that the Master of the Rolls (in whose custody the rolls of the Court in Chancery were) had authority to permit alterations to be made in the rolls, and his jurisdiction for that purpose remained unimpeached by the act of William IV. The jurisdiction originally inherent in this court had been acted upon under the Municipal Corporation Act in question respecting the authority given to the Lords of the Treasury of interfering with the rolls of the court in the cases of "The Attorney-General against the Corporation of Liverpool," and against the Mayor of Poole, where it had been laid down by the Lord Chancellor, that to exclude the jurisdiction of one court there must be not only another tribunal created, but an absolute exclusion of all other authorities enacted. In a case of charitable trusts, which were to be exercised in such manner as the Lord Chancellor should direct, there was an appeal from the direction to the House of Lords, in which the question whether that house had jurisdiction was not decided, but the opinion expressed was that they had not. In "the Attorney-General against Norwich," the judges were unanimous against the jurisdiction of the house. To exclude the jurisdiction of this court there must be an express legislative exclusion; and the mere giving an authority to another tribunal would not have that effect. Where a clerical mistake was established that might be corrected. Every court had an entire control over its own records, as the Court of Common Pleas had over fines and recoveries; whether the error were clerical or otherwise, it made no difference, for the record was not in the state it ought to be. The rolls of this court were under the control of the Master of the Rolls, and the state in which the records ought to be was subject to his determination, which must control the opinion of the Solicitor-General. The memorandums of alterations were filed with the specification and became part of it. Had there been an alteration by erasure and substitution of other words, a difficulty would have been created; but there was no difficulty here in ordering the memorandum to be taken off the rolls. The act had not given the Solicitor-General power to decide conclusively and without appeal what should or should not be on the rolls, nor had it excluded the jurisdiction of the judges of the court over its rolls. Suppose *per incuriam* or by mistake in his clerk a fiat for an inconsiderate alteration had been given, or suppose the fiat had been attached to a wrong memorandum, the Solicitor-General would have no authority after he had given his fiat to correct any mistake or fraud, nor would there be any means of making such correction if the jurisdiction of this Court were taken away. The effect of the fiat was merely that certain things should be placed upon the record, subject in all respects to the same conditions as the other records were. If the memorandum were not warranted, the Court could take it off. Had the statute made the fiat absolute, that could not have been done, but the fiat left the jurisdiction precisely in the same state it was in before, and it was for his Lordship to determine whether the memorandum of alterations ought or ought not to remain a record of the Court, and if not, his Lordship had jurisdiction to order it to be removed. He did not contend that his Lordship could order a patent to be taken off the rolls of the court on the ground that the invention was not new, but whether his Lordship was to decide whether such circumstances had existed as could justify the memorandum being put upon the rolls. The question was not to be determined by the law officers of the Crown without the control of any other authority. The act had not declared their fiat conclusive, nor had it extended any right given by the letters patent. The Legislature prevented the record being altered at the mere will of the parties, enacting that there must be the leave of the Attorney or Solicitor-General. Their fiat was not to extend the exclusive right granted by the letters patent, but this fiat extended those rights; therefore the memorandum of alteration was not such as the act allowed, and if so, the fiat was good for nothing. It might be said, that if the memorandum is not warranted by the act, the objection might be taken in an action at law; but the answer to that would be, that the alteration is incorporated into the letters patent, and alters the specification; and although the petitioner in an action at law might say the invention as specified in the alteration was neither new nor useful, he could not say it was no part of the specification, and he might have a right to have his action tried upon the original specification. If the fiat were conclusive, the alterations could not be averred to be no part of the record, for the statute had made them part of the record so long as the fiat remained. Unless the court had jurisdiction, the fiat would, in altering the records of the Court, be conclusive not only against the Court, but against the Attorney and Solicitor-General themselves, for the act had not provided a mode of amending any mistakes they might have been led into. Where surreptitious or forged documents were discovered to be placed upon the rolls of the court, it would be no answer to an application for their removal to say that an action could not be brought upon them. The Court would order an invalid instrument to be delivered up, on the ground that it formed a cloud upon the title of the individual whose interest was sought to be affected by it.

Mr. Hill and Mr. Bacon, for Mr. Sharp, against the petition, said the arguments for the petition were, that the specification with the alteration was a record of the court, that such records might be amended by his Lordship, that the prayer was in substance for an amendment, and that the petitioner had that interest in the question which authorized him to make the application. The specification with the alterations might for many purposes be a record, but under the colour of that general term inferences not quite sound had been drawn. The patent was granted upon a proviso that the patentee should at a certain time enrol a specification; but that proviso did not give the specification any of those high attributes of records which had been claimed for it. A record imported verity, and if the petitioner's argument was well-founded, no person could defend an action in which the patentee could prove an infringement of his patent. But from the statute of James I. these records had been treated only as the statement of a party who was bound to prove every averment he made, as that there was an invention, that he was the first inventor, &c. The patentee could not hold up his specification, and say "Here is a record, you are estopped from saying I am not the first inventor; my case was determined before we came into court." Nothing of that sort could be said. The specification was not a record in the sense and for the purposes for which that word had been used, nor was the memorandum incorporated in the specification such a record. In one of the cases cited (Redmond's) there was a clerical error, and that which had been intended was not done. If that had been the case here, his Lordship might, but with considerable trepidation, go back and bring the intention and the act which had parted company into agreement again; but his Lordship had been required to erect the Court into a court of appeal over judgment of the Solicitor-General, and to do what that officer might have done had he viewed the matter in a different light. Such a procedure would not come within the doctrine of amendments. It might as well be said that the reversal by writ of error of a judgment at common law was an amendment of the record; it was confounding things entirely different; it was not an amendment of the record, but the correction of the errors of an inferior court. In analogy to the practice of the common law, there must be something to amend by. The present was not a question of amendment. Before the statute of William IV. there was no authority that could enable a patentee to disclaim any part of his patent; it was a new power given to the Crown, and vested in its legal officers. By the common law the Crown had great powers in granting monopolies, which by the statute of James were restricted to new inventions, and to the term of 14 years, and where the patentee by his specification had made his claim too large, it was fatal to his patent; but the late act had given the Attorney-General power to permit the patentee to disclaim a portion of his patent. When a power was created by the Legislature and vested in a certain tribunal, then no other court had jurisdiction. The invention was only one condition—the inventor must have a patent and specification. The memorandum remaining on the files of the Court decided nothing but that the memorandum was authentic; it did not decide that there was an invention, or that the patentee was the inventor. The alleged invention might not be new, but that would be no reason for taking the memorandum off the files of the court. A bill in equity was not taken off the files of the court because it contained false allegations. If a judgment were erroneous, it would be a reason to appeal from it, but no reason to take it off the rolls of the court. The difference was between what was genuine and what was authentic. He did not argue that all was necessarily genuine, but he did say it was all authentic, and the question was to try the authenticity. The argument for the petition went to change the whole course of proceedings in patents from the time of James I., and he would advise his friend, who was the inventor of the doctrine, to get a patent for it. Whether it would stand as a new machinery for trying the validity of patents by their specification before the Master of the Rolls, would be a question. It was said that whatever had any vice would be taken off the rolls of the court, which would not bear anything on its rolls which contained an erroneous allegation. The question was, who was the new inventor? An issue could not be granted to determine the question of amendment. The Solicitor-General required advertisements to be made of the application to him, and gave it two hearings; so that the fiat for filing the memorandum of alterations was not granted in haste, but after due consideration. The validity of patents ought not to be decided in the present mode of proceeding. The mode of trying those questions had been settled for years, and ought not to be altered.

Mr. Pemberton replied. As long as the memorandum of the alterations with the fiat of the Solicitor-General remained as part of the rolls of the court, it would not be competent for any person to deny that the memorandum was a part of the specification on which the patent was granted. The statute did not authorize the memorandum to be placed on the rolls, for the memorandum did not form part of the specification. He would ask, had the Crown granted letters patent with the alteration? If it had, the objection that his Lordship had no power to interfere would be good; but if the memorandum were improperly placed, then it formed no part of the grant, and his Lordship would remove it from the record, as he would remove a forged specification or correct a clerical error.

Lord Langdale said, it was his duty to receive the records of the court, and in his character of recipient he had no doubt of his jurisdiction. He was to receive such documents as parties presented as the records of their own acts. If it were shown that documents had been presented which were not an accurate record, it would be his care to discover where the error arose, and to satisfy himself that it was an error. He would see what had been done upon former occasions.

Mr. Pemberton.—The question was not whether his Lordship could alter a record, but whether the enrolment as it stood was a record.

NEW INVENTIONS AND IMPROVEMENTS.

An improved method of retarding and stopping railway trains; patented by Henry Montague Grover, of Boveney, Buckingham, Nov. 7.—Claim first.—The application of electro or other magnetism, for the purpose of retarding or stopping railway trains.—A magnet, of the ordinary horse-shoe form, is let into a block of wood, and fixed by sustaining rods in such a position that its ends are a short distance from the face of the tire of one of the wheels. A galvanic battery is placed on the bed or platform of the carriage, and a connection of the magnet and the face of the tire of the wheel formed when necessary, by means of connecting wires, which will cause the wheel to be retarded or stopped. These magnets may be applied to any number of wheels in this manner, or through one magnet to a lever, and by cranks or other apparatus, indirectly to the wheels.—*Inventors' Advocate.*

An improved apparatus or process for producing sculptured forms, figures, and devices, in marble and other hard substances; patented by William Newton, of Chancery-lane, Middlesex, (being a communication from a foreigner residing abroad), Oct. 22.—These improvements consist, first, in the construction of a mould, die, or matrice, of metal or other hard substance, in which the counterform of the figure or device intended to be sculptured has been made, and its application to the stone or marble intended to be cut.—Secondly, in the means by which the sculpturing is effected; viz., by the repetition of slight but rapid blows of the mould, or die, struck against the face of the stone, by which the surface becomes abraded, and particles are gradually broken off, leaving the stone ultimately in a form, or figure, corresponding to the mould or die which has been working upon it.—Claim.—Application of a mould or striking die, which being by any arrangement made to strike a rapid succession of light blows on the substance to be sculptured, shall abrade or wear away the superfluous parts of the surface of the material under operation, and produce a form, or figure, corresponding with the mould or die.—The mould must be mounted in any convenient mechanical apparatus capable of holding, raising, and depressing it, that it may strike very light but rapid blows on the face of the block to be sculptured, which must be supported upon firm stationary bearings; the mould or die is securely attached to a lever, which is a strong frame of iron, mounted on pivots, which are made adjustable, in order to regulate the height of the frame, from the block of marble or stone; to the outer end of the lever a staple also adjustable by a screw and nut is fixed, to which is attached a cord, also connected to a series of cranks and rods, which are mounted in a horse-shaped frame; a crank in the lower end of this series is acted upon by stops, notches, or teeth, in the periphery of a tappet or rachet wheel, which is acted on by a pulley being made to revolve on its axis driven by a band from any first mover; so that on a rotary motion of the tappet wheel, its teeth will act against the arm of the lower crank, and produce a slight reciprocating motion in the series of cranks and rods, which will be communicated through the cord to the lever which holds the mould, thereby causing a rapid succession of slight blows to bear upon the surface of the block, and in a short time to abrade all those parts of the stone against which the mould or die strikes. The process will be facilitated by the introduction of sand, emery, or diamond dust, with water, at an early stage of the work, and may be introduced by a simple inclined plane, or in any convenient manner; towards the end of the process a finer powder should be used, and the work will leave the mould in a highly-finished state. This invention applies to busts, statues, and groups of figures, even the most complicated and extensive, and finishes them with the greatest delicacy, only it is necessary to employ several small moulds instead of one, and it will act equally well on crumbling stone, that would not bear the chisel, as upon a solid mass.—The inventor claims no particular arrangement of apparatus for causing the mould to strike the face of the block, although he considers that above described suitable and appropriate for the purpose.—*Ibid.*

A composition for the prevention of corrosion in metals, and for other purposes; patented by Arthur Wall, of Bermondsey, surgeon, October 15, 1840.—This composition is prepared in the following manner:—20 lb. of strong muriatic acid are diluted with 3 gallons of water and placed in a shallow cast iron vessel; 112 lb. of steel or iron filings are heated to redness and quenched in the diluted acid to effect their oxidation; to facilitate this action, the pan is placed on a furnace or sand-bath, and the contents repeatedly stirred for about 24 hours, or until ebullition takes place, the liquor is then drawn off, and the foregoing process repeated with such portion of the filings as remain unoxidized. The oxide thus obtained is exposed on a red hot iron plate, till all the moisture has been driven off, and the oxide assumes a red appearance. When cold, 16lb. of quicksilver are to be added to the mixture, by sifting through a fine sieve, and afterwards intimately incorporated in a mortar; enough water to cover the surface is then poured over it, and from 8 to 9 lb. of strong nitric or nitrous acid added; this mixture is to be placed in a sand-bath till all the moisture is driven off. When the mass is dry it is to be well pounded in a mortar till it assumes a uniform state of blackness. All the finer particles are to be separated by washing in water, and left to settle; the sediment is to be placed in a crucible or earthen retort, with a receiver attached to collect any chloride or mercury that may come over. When red hot plunge it into fresh boiling water, stir it well and leave it to settle, then draw off the water and add any chloride that may have come over into the receiver. Then add one-fourth of its weight of common black or red lead, according to the colour desired. This composition is to be mixed with boiled linseed oil with one fifth of spirits of turpentine, and applied as thinly as possible with a brush to the sheets of metal to be protected. The metal coated in this manner is to be dried by the application of heat, beginning with a low temperature, and gradually raised to about 300° of Fahrenheit, so as to make the metal "*imbibe*" the preparation. The claim is, for the invention of the composition prepared as above described, for the prevention of corrosion in metals, and for other purposes.—*Mech. Mag.*

STEAM NAVIGATION.

The Clyde.—There was launched, on the 27th October last, at Clyde Bank a new steam dredging vessel for the River Clyde trustees. This vessel is the largest of the kind which has yet been built on the Clyde; she is 100 feet long and 22 feet broad; she is to carry an engine of 24 horse power, and to work effectively in 18 feet depth of water. The engine for this vessel has been constructed by Mr. John Nelson, of Oak Bank Foundry, in accordance with the specification drawn up by Mr. Bald, engineer of the Clyde. This vessel is now in the harbour of the Broomielaw, for the purpose of receiving the engine and machinery on board. A very beautiful model of this vessel, on a scale of one foot to an inch, was exhibited in the model room of the British Association, and which was constructed under the direction of Mr. Bald, before the steam dredge-boat was built.

Navigation of the Mersey.—The *Warrington*, a new iron steamer, of 200 tons burthen, builder's measurement, built entirely (engines and hull) by the Warrington Bridge Foundry Company, made her first experimental trip down the Mersey to Liverpool and back on Wednesday, 11th ult. On her downward voyage she sailed remarkably well, and took in tow several flats bound for Liverpool. On her return home, she steamed from the Old Quay Pier, Liverpool, to the Old Quay, at Runcorn, in one hour and twenty-two minutes, towing one of Messrs. John Hodson and Company's flats. From Runcorn to Warrington, a distance of ten miles and a half, her speed was put to the test. In spite of a heavy fresh, and the disadvantage of getting up her speed after stopping at Runcorn, she completed the distance in forty-seven minutes. As far as the navigation of the Mersey is concerned, all difficulties thrown in the way of Warrington one day becoming a bonded port have now been made to disappear.—*Liverpool Times.*

The Mammoth Iron Steamer at Bristol.—A gentleman who has recently seen the immense iron steamer building by the Great Western Steam Ship Company at Bristol, informs us that she will *register* about 3,000 tons, but that her actual tonnage will exceed 3,600 tons, or about 600 tons more than any ship ever built. An immense saving in stowage will be gained in consequence of the adoption of iron for her hull, whilst her draught of water will be comparatively small, owing to the great buoyancy possessed by iron vessels. She will consequently be able to carry coals sufficient both for her outward and homeward passages,—a most important point, when the inferior quality of coals obtainable in America, and consequent diminution in speed, is considered. Her engines, we hear, are to be of 1000 horse power, and it is confidently expected that the average voyage across the Atlantic will be reduced to ten days. She will carry a vast spread of canvass, so that in all probability the engines will frequently be at rest. In consequence of the adoption of Smith's Screw Propeller, this stupendous ship, the greatest experiment in steam navigation ever made, will, we believe, be able to pass the present locks at Cumberland Basin, and discharge her cargo in Bristol Harbour. We congratulate our Bristol neighbours upon the enterprise which they are displaying. Two magnificent steamers are now building at Bristol, by Messrs. Acraman, for the Royal Mail Company; and, altogether, the ancient port seems to be "going a-head."—*Gloucester Chronicle.*

Iron Steamer.—On Saturday the 21st ult., was launched from Messrs. Ditchburn and Mare's building yard, at Blackwall, a wrought iron steam vessel of 160 tons, named the "Mermaid," to be propelled by an engine on an entirely new principle, of 50 horse power, invented expressly to drive the Archimedes screw without the aid of geering-wheels. Should its power equal its simplicity, it is likely to cause a change in steam engines. The engine is making by Messrs. Rennie's.

Prevention of Steam Packet Collisions.—The Corporation of the Trinity House has deemed it right to frame and promulgate the following rules, "which, on communication with the Lords Commissioners of the Admiralty, the Elder Brethren find have been already adopted in respect of steam-vessels in Her Majesty's service." Rule first—"When steam-vessels on different courses must unavoidably or necessarily cross so near that by continuing their respective courses there would be a risk of coming into collision, each vessel shall put her "helm to port,' so as always to pass on the larboard side of each other." Rule second—"A steam vessel passing another in a narrow channel must always leave the vessel she is passing on the larboard hand."

Steamers Wanted.—We had hoped that the cry of "steamers wanted" which we have continually kept up for the last two years, would before this have been responded to by the arrival of steamers from England; but as we see that that the subject was alluded to in several London and Liverpool papers of November and December last, we still hope that many months will not elapse before several steamers arrive in the colony. The following steamers are now urgently wanted, in fact we are suffering much from the want of them:—Two large steam-boats to run from Port Philip to Sydney; a large boat to run from Sydney to New Zealand; a second to be added in about 12 months; three boats to run to Hunter's River; a boat to run to William's River; a boat to run to Brisbane Water; a couple of small boats to run between Newcastle and the different towns on the Hunter, Williams, and Paterson. Besides the above, a boat will be required to run to Twofold Bay very shortly, as the country between there and Manaroe, called the Bija country, is beginning to attract attention; boats for Jervis's and Bateman's Bay will soon be required. We consider the above boats are required at once, in addition to those now here, for there will always be some of the vessels meeting with accidents, and otherwise requiring repair, and it is of the greatest importance that boats should run regularly. Although the above are urgently required, we believe that the only boats that can be depended upon, as sure to arrive during the present year, are two for the Hunter's River Company, and one for Port Philip. Half a dozen vessels of different burdens sent to this colony would be a splendid speculation.—*Sydney Herald*, May 15.

PROGRESS OF RAILWAYS.

America.—There are now 2,270 miles of railroads completed, or nearly completed, in the United States, besides 2,346 miles of railroads in progress of construction, making a total (when finished) of 4,616 miles.—*Times.*

Greenwich Railway.—Tenders as delivered on Tuesday, 3rd November, for widening the Greenwich Railway, from the Croydon Junction to Tooley Street, (extending *nearly a mile* for the present contract.)

Mr. Jackson	£34,900
Messrs. Grissell and Peto	37,791
Messrs. Baker & Son	38,734
Messrs. Little & Son	38,800
Mr. Lee	38,850
Messrs. Piper & Son	39,300
Mr. Bennett	39,972
Messrs. Ward	43,320
Mr. M'Intosh	43,500
Mr. Grimsdell	46,596

Taff Vale Railway.—We are glad to perceive that the promoters of the prosperity of this town, are not unmindful of the inducements which its great natural advantages hold out for the accomplishment of railway communication with other districts of the kingdom, as well as the importance of meeting other places in the race of competition by the aid of this grand achievement of modern science. The progressive commercial importance, and the exhaustless mineral wealth of Newport and its neighbourhood, have been so frequently the theme of observation in this journal, that it would be superfluous at present to dwell on facts, admitted by all, as incentives to action during the railway undertakings now completed or in course of operation through the leading districts of the kingdom. Our position is commanding, our advantages great, and our exertions should be commensurate to obtain a participation in the benefits for our town and port, and for the county at large, that railway communication with the great arteries of the traffic of the kingdom, is now diffusing. A railway is projected between Newport and Gloucester, taking the circuit of Monmouth and Usk. We understand that Mr. Barber, late of the Taff Vale Railway, a gentleman highly spoken of as possessing great talents in his profession, is directing his best energies to the subject, and with the support he has already received, we augur well for the maturity of his plans. The question shall be resumed in our columns.—*Monmouthshire Merlin.*

South-Eastern Railway.—This great undertaking is now proceeding with the utmost vigour; all the works between Tunbridge and Redhill are in a state of great forwardness, it being the intention of the directors to open the line as far as Tunbridge, with the least possible delay. The tunnel, near the village of Bletchingly, which is a particularly arduous and heavy structure, is also progressing considerably. This is one of the most interesting works upon the line, particularly to the geologist, as it passes under ground near the foot of Tilburston-hill, which it is well known has been subjected to some powerful subterraneous action, the strata upon some parts of the hill being singularly distorted. All the phenomena observed by the engineer in the progress of the work shows this spot to have been peculiarly subjected to the upheaving and disturbing powers which, at some remote period, have been in active operation. Mr. Simms, the engineer, who resides at Bletchingly, is in possession of several interesting fossils, which he has found in the progress of his work.—*Sussex Express.*

Gloucester and Monmouthshire Railway.—Agreeably to our promise, we this week recur to the subject of a railway from Newport to Gloucester. It appears that two lines have been surveyed, the one by Usk and Monmouth, the other by Chepstow and Newnham; and it is a matter of the greatest moment to arrive at a sound conclusion, as to which line will best subserve the interests of the public, and of the districts through which it passes. We have been long impressed with the importance, and indeed, the necessity for a railway communication through this rich and greatly improving district; and having attentively considered the subject, it appears that there can be but one opinion as to the eligibility of the central line, and of the impolicy of allowing a trifling difference of cost, to weigh in the consideration of a question involving results of such paramount advantage The line proposed, to follow the banks of the Severn, is open to so many objections from its being parallel with a fine navigation, and with a probability of another railway from Gloucester to Bristol being carried along the opposite bank, that we think it will not bear comparison with a line embracing towns of importance, and laying open a splendid district of country, greatly needing the facilities of railway communication. The traffic from the important districts of Pontypool, Abergavenny, Brecon, &c., largely flow into the line near Usk, and the City of Hereford would doubtless communicate near Ross. The central character of this line affords a guarantee that traffic will be derived on every side. We have had the pleasure of inspecting the plans of the line surveyed by Mr. Barber, and as our readers feel great interest in the subject, we will endeavour to obtain the details of its course.—*Bristol Paper.*

Proving Steam-Engine Boilers in Belgium.—By a decree of King Leopold, dated Oct. 28. it is ordained :—" That every boiler in which the steam is required to have a pressure of more than one atmosphere shall be submitted to a proof of treple the force it will be required to support. This pressure to be determined by the difference between the authorised pressure of the steam in the boiler and atmospheric pressure.—Considering that tabular boilers of locomotive engines may safely be exposed to less rigorous proof, on the report of our Minister of the Public Works, we have decreed,—Article 1. That the boilers of locomotive engines intended to run on railroads shall be submitted to a proof of twice the amount those engines are required to support.—Art. 2. The permission to make use of locomotives belonging to the state will be granted after the trials prescribed by the articles of the first and second decree, by the director of the railroads now in operation.—Art. 3. The proof of the locomotive engines shall be renewed at least once a year ; they shall take place after every important repair of the boiler. The boilers that are injured during the proof shall not be used.—Art. 4. The director of the railroads in operation shall address to our Minister of the Public Works a duplicate of the permission to use the engines, and of the declarations of proof."

Thames Haven Dock and Railway.—Considerable exertions are being made for pushing forward this important undertaking in the ensuing spring.

MISCELLANEA.

Mast Conveying.—It has been usual of late, since it has been considered objectionable to immerse made masts in the water. to send them from the mast-houses on trucks, a process which does them no good, and occupies a whole day when a line-of-battle ship's lower mast is to be dealt with. A method, however, was tried on Tuesday last with the Indus's foremast. and it answered admirably, to convey it by water, without wetting it, in the following way :—Two flat-bottomed boats, placed side by side, and having strong skids laid on their gunwales, were brought to the slipway, at the back of the mast-houses, and properly placed ; the mast was then launched out until it projected beyond the boats, and over the centre of the skids until its heel end rested upon them ; the launching of the mast was then continued, the boats bearing it, and another pair of flat-bottomed boats, similarly fitted with skids, were brought and placed under the mast towards its head, which, as it descended the slip, presently rested on them, as the heel had done before, upon the skids of the boats first placed ; the tressel trees were then bolted on, and the flats with their burden were towed away to the sheers, where the Indus was waiting for, and very soon received, her foremast, which had thus been conveyed perfectly dry. This novel operation was carried into effect under the superintendence of the officers of the mast-house ; for the idea, however, and also the details of the scheme, the service is indebted to Mr. Whettem, an intelligent and zealous inspector in the mast-making department.—*Times*, Nov. 2.

A steam fire-engine has been invented at New York, by Captain Erichsen. It weighs only 2¼ tons, and will throw 3,000 pounds of water per minute to a height of 105 feet, through a nozzle of 1½ inch diameter.—*Times.*

Patent Wire Rope for Standing Rigging.—Last week a series of trials of Smith's Patent Wire Rope was made at the Corporation testing-machine, in Trentham Street, Liverpool, in presence of a number of nautical gentlemen and others interested in improvements in navigation, and the result was highly satisfactory. The patent consists of improved methods of forming a rope from any number of wires that shall be flexible, is served with hemp, and can also be spliced or knotted. The rope is tarred in the usual way, so as to exclude the water ; and a chemical preparation is employed to prevent oxidation. The rigging with wire rope is smaller and lighter than of hempen rope, and as it offers much less resistance to the wind, is of great advantage in beating to windward. The cost, too, is much less, and the durability greater. In the trials we have alluded to, the following results were ascertained :—

1-inch rope broke at 2 tons 1 cwt.
1½ .. .. 5 .. 0 ..
2⅜ .. .. 8 .. 14 ..

other sizes were also tried with proportionate success ; and it should be remarked, that a *three inch* hempen rope of the best quality broke at 2 tons 1 cwt. The weight or traction borne by each piece of different sized rope far exceeded that fixed in the scale of the patentee, thus showing great superiority in the workmanship of the manufacturers, Messrs. Fox and Co. of London and Birmingham. According to the scale alluded to, the weight to be sustained by 1½ inch wire rope is 3 tons 10 cwt., and so in proportion. Another good quality of the wire rope is its elasticity, which, though not of course equal to that of hemp rope, is quite sufficient to counteract the effects of a sudden jerk while a vessel is rolling heavily at sea. One comparatively short length of rope that was tried, stretched 18½ inches before it broke. A very short length of 1½ inch stretched 6 inches. The machine on which the tests were made is very ingenious, and of tremendous multiplying power ; it is that on which iron cables for the largest ships are put to their utmost tension of many tons. The gentlemen present took a deep interest in the operations, and were at once gratified and astonished to witness the immense weight or traction sustained by lengths of wire rope so comparatively small and light. It should be added, that this patent rigging has been tested at sea upwards of five years, and that amongst the ships fitted with it in our own port are those crack steamers the *Oriental* and the *Liverpool*. The new light ship, the *Albert*, destined for the Victoria Channel, is also rigged with it, and it has hitherto been highly approved by practical men.—*Liverpool Standard.*

Survey of the Northern Counties of England.—We have much satisfaction in conveying the gratifying intelligence that the secretary of the Manchester Geological Society has received a communication from the Lords of the Treasury, announcing their intention to conduct the survey of the six northern counties of England, on an enlarged scale of six inches to the mile, instead of two inches, the size adopted for the other counties, and that they are to commence with Lancashire forthwith. This is a matter of very great importance to the landed interest, as well as to the proprietors of mines, coal mines, and quarries, and hence to the community at large, in this thickly peopled district. For this important improvement in the survey, we are indebted to the exertions of the Geological Society of Manchester, with whom the idea originated. They memorialised the Treasury, and influenced other scientific societies to follow their example, and thus paved the way to this important result. This fact alone proves the high importance of the Geological Society, seeing that their first acts are directed to the prosperity of the county and its varied mercantile interests. It is, therefore, the duty of the gentlemen of this and the surrounding towns to become members of this society, and by increasing its funds enable it to pursue its useful and laudable exertions with increased vigour.—*Manchester Chronicle.*

Ancient Window.—An ancient stained glass window of the 15th century, which formerly belonged to a convent at Mechlin, has just been placed in the church of St. George's, Hanover Square.—*Times.*

Improvement of the Severn.—The *Bristol Journal* has the following remarks upon the proposed improvement of the navigation of the river Severn ;—" In the trading interests of Bristol, this long-wanted improvement must be of the greatest advantage in developing and carrying out those vast enterprizes which our fellow citizens have of late projected with such laudable spirit and liberality ; thereby securing to them the readiest and cheapest conveyance of the vast mineral products and the produce of the potteries of Staffordshire, the salt of Droitwich, and the various manufactures of Birmingham and its neighbourhood, through the Worcester and Birmingham canal ; nor will the port of Gloucester, and more particularly those of Newport and Cardiff, in South Wales, be less benefitted. In the present migratory state of commerce and manufactures, with competition every where taking place, and in which the minutest fraction in cheapness and certainty of conveyance will turn the scale, we do consider the contemplated improvement of first-rate advantage to Bristol. The great wonder is, that such an anomalous state of things, in these days of commercial enterprise, should so long have been suffered to exist."

LIST OF NEW PATENTS.

GRANTED IN ENGLAND FROM 2ND NOVEMBER TO 25TH NOVEMBER, 1840.

JOHN DUNCAN, of Great George Street, Westminster, Gentleman, for "*improvements in machinery for cutting, reaping, or severing grass, grain, corn, or other like growing plants or herbs.*" Communicated by a foreigner residing abroad.—Sealed November 2 ; six months for enrolment.

ELIJAH GALLOWAY, of Manchester Street, Engineer, for "*improvements in propelling railroad carriages.*"—November 2 ; six months.

JOSIAH HUMPHREY, of New Tower Row, Birmingham, Brass Founder, for "*certain improvements in machinery to be employed in the manufacture of wire hooks and eyes.*"—November 2 ; six months.

HENRY WIMSHURST, of Limehouse, Ship Builder, for "*improvements in steam vessels, in communicating power to propellers of steam vessels, and in shipping and unshipping propellers.*"—November 2 ; six months.

JAMES HEYWOOD WHITEHEAD, of Royal George Mills, York, Manufacturer, for "*improvements in the manufacture of woollen belts, bands, or driving straps.*"—November 2 ; six months.

JAMES BOYDELL, junior, of Cheltenham, for "*improvements in working railway and other carriages, in order to stop them, and also to prevent their running off the rails.*"—November 2 ; six months.

JOHN EDWARD ORANGE, of Lincoln's Inn Old Square, Captain in the 81st Regiment, for "*improvements in apparatus for serving ropes and cables with yarn.*"—November 2 ; six months.

HERMAN SCHROEDER, of Surrey Cottage, Peckham, Broker, for "*improvements in filters.*" Communicated by a foreigner residing abroad.—November 2 ; six months.

JOHN WORDSWORTH ROBSON, of Wellclose Square, Artist, for "*certain improvements in water closets.*"—November 2 ; six months.

RICHARD FARGER EMMERSON, of Walworth, Gentleman, for "*improvements in applying a coating to the surfaces of iron pipes and tubes.*"—November 3 ; six months.

JOHN RAPSON, of Limehouse, Millwright, for "*improvements in paddle-wheels for propelling vessels by steam or other power.*"—November 3 ; six months.

HENRY HIND EDWARDS, of Nottingham Terrace, New Road, Engineer, for "*improvements in evaporation.*"—November 5 ; six months.

PIERRE MATHEW MANNOURY, of Leicester Square, Gentleman, for "*improvements in wind and stringed musical instruments.*" Communicated by a foreigner residing abroad.—November 5 ; six months.

GEORGE GWYNNE, of Duke Street, Manchester Square, Gentleman, for "*improvements in the manufacture of candles, and in the operating on oils and fats.*"—November 5 ; six months.

GEORGE DACRES PATERSON, of Truro, Esquire, for "*improvements in curvilinear turning, (that is to say) a rest adapted for cutting out wooden* *bowls, and a self-acting side rest for other kinds of curvilinear turnings.*"—November 5; six months.

Henry Kirk, of Blackheath, Gentleman, for "*improvements in the application of a substance or composition as a substitute for ice for skating and sliding purposes.*"—November 5; six months.

Charles Joseph Hullmandel, Great Marlborough Street, Lithographic Printer, for "*a new effect of light and shadow, imitating a brush or stump drawing or both combined, produced on paper, being an impression from a plate or stone prepared in a particular manner for that purpose, as also the mode of preparing the said plate or stone for that object.*"—November 5; four months.

John Clarke, of Islington, Lancaster, Plumber and Glazier, for "*an hydraulic double action force and lift-pump.*" Communicated by a foreigner residing abroad.—November 5; six months.

George Delianson Clark, of the Strand, Gentleman, for "*an improvement in purifying tallow fats and oils for various uses, by purifying them and depriving them of offensive smells, and solidifying such as are fluid, and giving additional hardness and solidity to such as are solid, and also by a new process of separating stearine or stearic-acid from the elanie in such substances.*" Communicated by a foreigner residing abroad.—November 5; six months.

Alexander Horatio Simpson, of New Palace Yard, Westminster, Gentleman, for "*a machine or apparatus to be used as a movable observatory or telegraph, and as a movable platform in erecting, repairing, painting, or cleaning the interior and exterior of buildings. and also as a fire-escape.*" Communicated by a foreigner residing abroad."—November 5; six months.

Andrew Kurtz, of Liverpool, Manufacturing Chemist, for "*a certain improvement or certain improvements in the construction of furnaces.*"—November 5; six months.

George Halpin, junior, of Dublin, Civil Engineer, for "*improvements in applying air to lamps.*"—November 7; six months.

William Crofts, of New Radford, Nottingham, Machine Maker, for "*certain improvements in machinery, for the purpose of making figured or ornamental bobbin-net or twist-lace, and other ornamental fabrics looped or woven.*"—November 7; six months.

Charles de Bergue, of Blackheath, Gentleman, for "*improvements in machinery for making reeds used in weaving*" Communicated to him by a foreigner residing abroad.—November 7; six months.

Edward Dodd, of Kentish Town, Musical Instrument Maker, for "*improvements in piano-fortes.*"—November 7; six months.

George Edward Donisthorpe, of Leicester, Machine Maker, for "*certain improvements in machinery or apparatus for combining and preparing wool, and other textile substances.*"—November 7; six months.

John Joseph Mechi, of Leadenhall Street, Cutler, for "*improvements in apparatus to be applied to lamps, in order to carry off heat and the products of combustion.*"—November 10; two months.

Thomas Lawes, of Canal Bridge, Old Kent Road, Feather Factor, for "*certain improvements in the method or process, and apparatus for cleansing or dressing feathers.*"—November 10; six months.

William M'Kinley, of Manchester, Engraver, for "*certain improvements in machinery or apparatus for measuring, folding, plaiting, or lapping goods or fabrics.*"—November 10; six months.

Charles Edwards Amos, of Great Guilford Street, Millwright, for "*certain improvements in the manufacture of paper.*"—November 10; six months.

Thomas William Parkin, and Elisha Wilde, of Portland Street, Liverpool, Engineers, for "*an improved method of making and working locomotive and other steam-engines.*"—November 12; two months.

Eugenius Birch, of Cannon Row, Westminster, Civil Engineer, for "*improvements applicable to railroads, and to the engines and carriages to be worked thereon.*"—November 12; six months.

John Heaton, of Preston, Overlooker, for "*improvements in dressing yarns of linen, or cotton, or both, to be woven into various sorts of cloth.*"—November 12; six months.

Otto C. Von Almonde, of Threadneedle Street, Merchant, for "*improvements in the production of Mosaic work from wood.*" Communicated by a foreigner residing abroad.—November 12; six months.

Charles Dod, of Buckingham Street, Adelphi, Gentleman, for "*certain methods or processes for the manufacture of plate-glass, and also of substances in imitation of marbles, stones, agates, and other minerals, of all forms and dimensions, applicable to objects both of use and ornament.*" Communicated by a foreigner residing abroad.—November 12; two months.

Charles Wye Williams, of Liverpool, Civil Engineer, for "*certain improvements in the construction of furnaces and boilers.*"—November 17; six months.

Joshua Shaw, of Goswell Street Road, Artist, for "*certain improvements in discharging ordnance, muskets, fowling-pieces, and other fire-arms.*"—November 17; six months.

Joseph Whitworth, of Manchester, Engineer, and John Spear, of the same place, Gentleman, for "*certain improvements in machinery, tools. or apparatus for cutting and shaping metals and other substances.*"—November 17; six months.

James Deacon, of Saint John Street Road, Gentleman, for "*improvements in the manufacture of glass chimneys for lamps.*"—November 19; six months.

Alexander Stevens, of Manchester, Engineer, for "*certain improvements in machinery or apparatus to be used as an universal check for turning and boring purposes, which said improvements are also applicable to other useful purposes.*"—November 19; six months.

William Henson, of Allen Street, Lambeth, Engineer, for "*improvements in machinery for making or producing certain fabrics with threads or yarns applicable to various useful purposes.*"—November 19; six months.

John Cox, of Ironmonger Lane, Civil Engineer, for "*certain improvements in the construction of ovens applicable to the manufacture of coke, and other purposes.*"—November 21; two months.

John Wakefield, of Salford, Hat Manufacturer, and John Ashton, of Manchester, Hat Manufacturer, for "*certain improvements in the manufacture of hat bodies.*"—November 21; six months.

William Henry Hutchins, of Whitechapel Road, Gentleman, and Joseph Bakewell, of Brixton, Civil Engineer, for "*improvements in preventing ships and other vessels from foundering, and also for raising vessels when sunk.*"—November 21; six months.

Francis Pope, of Wolverhampton, Engineer, for "*improvements in detaching locomotive and other carriages.*"—November 24; six months.

John Haughton, of Liverpool, Clerk, M. A., for "*improvements in the means employed in railway accidents resulting from one train overtaking another.*"—November 24; six months.

Henry Charles Danberry, residing at Boulogne, Esquire, for "*an improvement in the making and forming of paddle-wheels for the use of vessels propelled on the water by steam or other power, and applicable to propel vessels and mills.*"—November 25; six months.

Thomas Barratt, of Somerset, for "*improvements in the manufacture of paper.*"—November 25; six months.

Junius Smith, of Fen Court, Fenchurch Street, Esquire, for "*certain improvements in furnaces.*" Communicated by a foreigner residing abroad.—November 25; six months.

Charles Grellett, of Hatton Garden, for "*new modes of treating potatoes in order to their being converted into various articles of food, and new apparatus for drying, applicable to that and other purposes.*"—November 25; six months.

William Henry Bailey Webster, of Ipswich, Surgeon, for "*improvements in preparing skins and other animal matters, for the purpose of tanning, and in the manufacture of gelatine.*"—November 25; six months.

Oliver Louis Reynolds, of King Street, Cheapside, Merchant, for "*certain improvements in machinery for producing stocking fabric or framework knitting.* Communicated by a foreigner residing abroad.—November 25; six months.

Nathaniel Batho, of Manchester, Engineer, for "*certain improvements in machinery, tools, or apparatus, for planing, turning, boring, or cutting metals, and other substances.*"—November 26; six months.

Frederick Theodore Philippi, of Bellfield Hall, Calico Printer, for "*certain improvements in the art of printing cotton, silk, and other woven fabrics.*"—November 25; six months.

James Lee Hannah, of Brighton, Doctor of Medicine, for "*an improvement or improvements in fire-esc apes.*"—November 25; six months.

Robert Roberts, of Bradford, Blacksmith, for "*a new method or process for case hardening iron.*"—November 25; six months.

Henry Walker Wood, of Chester Square, Gentleman, for "*an improvement in producing an uneven surface in wood and other substances.*" Communicated by a foreigner residing abroad.—November 25; six months.

TO CORRESPONDENTS.

Notice.

The present Number concludes the Third Volume. The Title, Preface, and Index will be given extra with the next month's Journal.

Vols. 1, II, and III, may be had, bound in cloth, price £1 each Volume.

"A Constant Reader." *We have not seen the carriage.*

We have received two other letters besides the one inserted respecting Mr. Mansel's proposition for using marbles to check the lengths of the chain; we think it unnecessary to publish any other than the one by a "Surveyor."

James Inglis's *letter commenting on our remarks, regarding his conduct, in last month's Journal, we must decline publishing. We are at all times disposed to lend our aid in crushing plagiarism; in doing so we must be supported by facts, and no part of the statement should contain any matter but what could be fully proved in a court of law, to which we render ourselves liable to be brought, when vindicating any particular interest, or exposing piracy. Mr. Inglis stated in his letter, that his assertions could be supported by written documents, which, upon investigation, turned out not to be the case. We therefore cannot allow any further correspondence on the subject of "Tide Gauges," unless it is the wish of either Mr. Mitchell or Mr. Bunt.*

A Road Engineer. *We shall attend to the Report on Turnpike Roads next month.*

Books received:—Lecount on the London and Birmingham Railway; Parsey on Perspective; Williams on Combustion; Pambour on the Steam Engine.

Communications are requested to be addressed to "The Editor of the Civil Engineer and Architect's Journal,' *No.* 11, *Parliament Street, Westminster.*

Books for review must be sent early in the month, communications on or before the 20th (if with drawings, earlier), and advertisements on or before the 25th instant.

THE NEW YORK PUBLIC LIBRARY
REFERENCE DEPARTMENT

This book is under no circumstances to be taken from the Building

form 410